PPG

WAVE 2.3

operations manual by Dominic Milano

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INTRODUCTION

The PPG Wave 2.3 is an eight-voice polyphonic synthesizer with a pressure-sensitive five-octave keyboard. Its distinctive sound comes from the combination of 16 digital oscillators (assigned two per voice), which produce over 1,800 waveforms, and more traditional analog voltage-controlled lowpass filters. The waveforms can be swept by one of each voice's three envelope generators, an effect that produces waveform cascades, and other features include the capability to play up to eight sounds at once on the keyboard using seven user-programmable split points, the ability to layer sounds in a variety of ways, an eight-voice digital sequencer with multi-parameter automated mixing capability, MIDI, separate outputs for each voice, and 12-bit audio resolution. In addition, there are two groups of 87 user-definable programs, along with 20 Combiprogams, which consist of sets of eight programs and two separate banks of keyboard arrangements.

Those of you familiar with the 2.3's predecessor, the Wave 2.2, will be interested to know that the Wave 2.3 can be put into 2.2 mode, where it behaves exactly like a 2.2.

Because the 2.3 is based on designs developed over a period of years, there are a lot of hidden functions, which won't be obvious to those familiar with more conventional synthesizers. There are also a couple of leftovers from previous versions that don't do much of anything in the current model 2.3. For these reasons, we recommend reading the manual as you experiment with the instrument's many features.

For those anxious to quit reading and start playing, we'd recommend reading the first section and then skimming the second, if only to get some idea of how to get around the front panel. After you've walked through the detailed decriptions of how things work, you'll find quick reference guides to all the instrument's displays and panel controls at the end of the manual.

Section 1 covers unpacking and setting up.

Section 2 deals with getting sounds and becoming familiar with the use of the front panel, the many different displays, and the wavetables.

Section 3 deals with the eight-channel polyphonic sequencer, and interfacing with external sequencers.

Section 4 explains the 2.3's MIDI implementation.

Section 5 tells about using the cassette interface for external data storage.

Section 6 is a quick reference guide to all the instrument's functions.

Don't rush the learning process. The PPG is an instrument with a lot of features. It will take time to learn them all.

If you should run across a function that doesn't seem to operate as described in this manual, it's probably because your instrument is equipped with different internal operating software. The most recent update at the time of this writing was version 5.4 (the software version in your instrument will be shown in the Main Display). Consult PPG for details on how to get the most current software installed in your instrument.

Those of you familiar with the 2.3's predecessor, the Wave 2.2, will notice a few major differences in the operation of the two systems--notably the Combiprogram display, the sequencer, and the inclusion of MIDI. These are explained in sections 2, 4, and 6; skip ahead to get straight into these new parameters.

CONTENTS

SETTING UP

Carefully unpack your instrument. If you don't plan on purchasing a flight case, save the box and all packing materials in case you should need to ship it in the future.

Make sure that you place the instrument in a location that provides the rear vents adequate ventalation.

Connect the AC power cord to the back of the instrument. If you have an instrument with an AC selector switch on the back panel, **make sure the switch is set to the proper voltage before turning on the instrument:**

U.S.= 115V
Europe= 220V

Note that on newer instruments, this switch is internal and preset at the factory for the proper voltage. Should you plan on taking your instrument to a different country, please consult section 7 for details on how to change the voltage setting on newer instruments.

The cord that is supplied with the PPG has three prongs, be sure to connect it to an outlet that is suitably grounded.

The two stereo audio outputs are located on the back panel, on the side opposite the AC power connector and on/off switch. There are also individual outputs for each of the eight voices; however, we'll leave these be for now. With your amplifier off, connect the stereo outputs, labelled **CH1** and **CH2**, to your amplifier or mixing board with 1/4" phone plugs. It makes no difference which channel you assign to the left and to the right.

Locate the **BASIS** pot on the far left of the front panel and turn it fully to the right for stereo operation. This pot adjusts the width of the stereo affect.

If your amplification system is monophonic, connect either CH1 or CH2 to your amp (it makes no difference which you choose). Then turn the **BASIS** pot counter-clockwise until it points to 0 (MONO).

Next, switch the PPG's power on (the switch is located on the back panel next to the power cord connecter). It will take about 10 seconds for the PPG to boot up--during this time, the instrument is loading eight soundprograms into its memory.

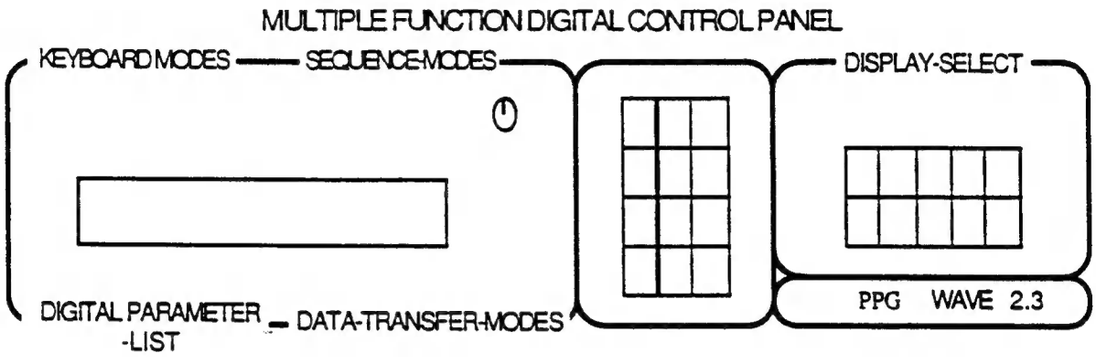
Turn the **MASTER VOLUME** control down to 0. Turn your amp on and set its volume to 0 (if you're using a mixer, leave the amp alone and turn the mixer level down). Turn the PPG's **Master Volume** control up to about 8 for the best signal-to-noise ratio. Now turn the volume on you amplification system up to a comfortable level.

If no sound occurs, recheck all connection and cords. Remember that it takes the PPG about 10 seconds to become active after power up.

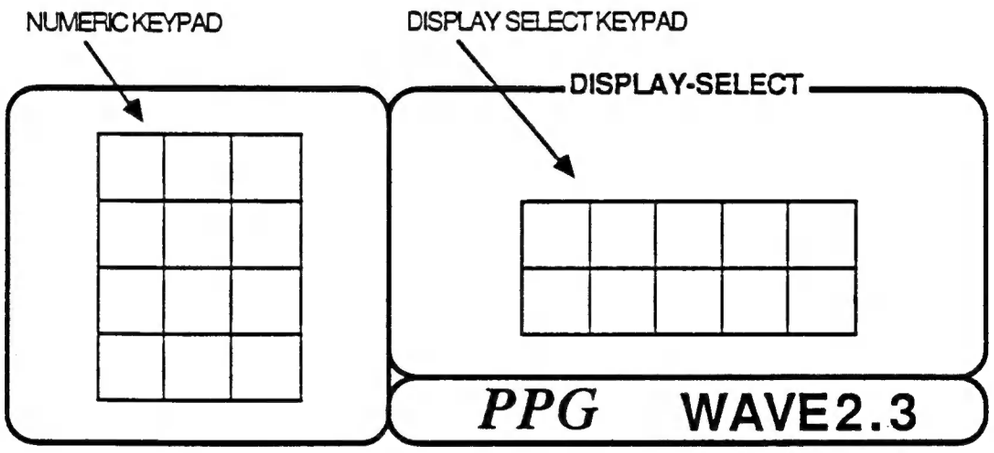
NOTE: It would be a good idea to make sure you store the cassette tape that was supplied with your 2.3 in a safe place. It contains the factory presets for your instrument. Should you accidently erase or modify a factory sound while learning to use the instrument and later desire to get that sound back, you'll be able to recover it with this data cassette.

A QUICK OVERVIEW OF THE FRONT PANEL

If every function of the PPG had received its own front-panel control, the instrument would have been much too large and cumbersome. In an effort to cut down on overall size and weight, many controls were assigned multiple functions. These different functions are accessed through the **MULTIPLE FUNCTION DIGITAL CONTROL PANEL** located on the right side of the front panel.



The **Display-Select keypad** is used to quickly access different functions, while the **Numeric keypad** is used to enter parameter values in the **Display Window** located in the center of the panel.

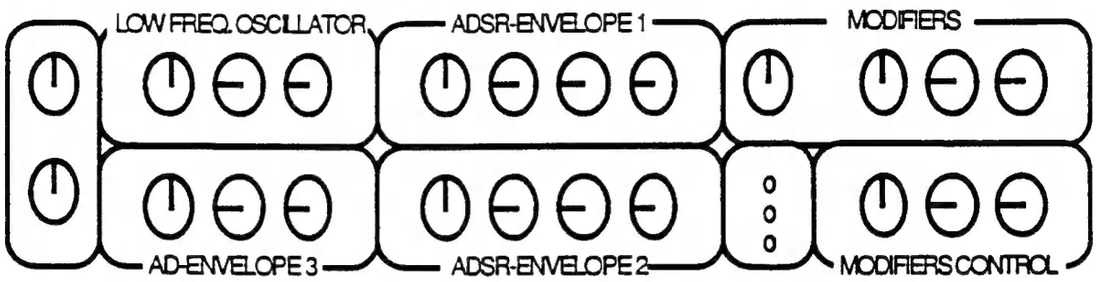


Many numbers entered with the numeric keypad have to have two digits, so that the number one is entered as 01, two is 02, three is 03, and so on. Zero is 00, although the display will show only one 0. The

exceptions to this rule are to be found in the Digital display, the Tuning display, and the Sequencer display.

The other half of the front panel contains the **MULTIPLE FUNCTION ANALOG CONTROL PANEL**, which interacts with the **MULTIPLE FUNCTION DIGITAL CONTROL PANEL.**

MULTIPLE FUNCTION ANALOG CONTROL PANEL



This section of the manual will explain how to make use of the **MULTIPLE FUNCTION DIGITAL CONTROL PANEL** and its **Display Window** to step through factory presets and access different functions using the **Display-Select keypad.**

DEALING WITH THE DISPLAY WINDOW

The heart of the PPG is the backlit LCD (liquid crystal display) located in the center of the front panel. It is called the **Display Window.**

If you can't see the display well enough, turn the small knob located to the upper right of the Display Window. This control varies the brightness of the display. Turn it until you can read the type in the window. Note that if you change the location or position of the PPG, you may have to tweak this control to make the type more visable.

The Combiprogram Display. When the PPG is first turned on, the display will briefly show a series of letters (R\T, A, C, D, E). You needn't worry about these--they represent a series of routines that the computer goes through on power up. The next thing you will see fill the display looks like this:

```
CP:  0 BK: 0a 0a 0a 0a 0a 0a 0a 0a
GR:a=BK:0DET:0 KBM:0 SPL#1 KEY:0 DTF:0
```

This is the **Combiprogram Display.** It is always the first thing to come up in the display window. The Combiprogram Display allows you to do things like call up sounds (which we will refer to from here on as soundprograms), set up to seven split points on the keyboard, and use the datatransfer function. Before we go any farther, let's take a look at how to move around this display.

The Cursor. Just after powering up, you probably noticed a small horizontal line move across the upper part of the screen underneath the eight 0a's. In case you missed it, it's parked under the 0 next to the letters **GP:=aBK:** This is the **cursor.**

The **cursor** can move in two directions, left and right. You have to move it under parameters in the display in order to access those parameters.

Parameters are always displayed as abbreviations followed by a colon (:) and then a number or two. For example, the **CP:** in the display respresents **Combiprogram,** which is short for Combination Program. The number on the other side of the colon, in this case, indicates that **Combiprogram number 0** is currently called up.

COMBIPROGRAM DISPLAY ABBREVIATIONS

CP: combiprogram (numbers 00-19).

BK: bank (used for loading and displaying up to eight soundprograms [00-86] for each of the 20 combiprograms).

GR: A or B, selected from the Display-Select **GROUP** button. Determines which set of keyboard splits is heard.

DET: detuning, used to turn the suboscillators on and off in all banks simultaneously. Even numbers (0-8) turns them on. Odd numbers (1-9) turn them off. Note that they suboscillators have to be used in a particular patch for you to hear this effect.

KBM: keyboard mode (0-3 as listed on front panel). The number 9 here is for use with the optional PRK Processor Keyboard.

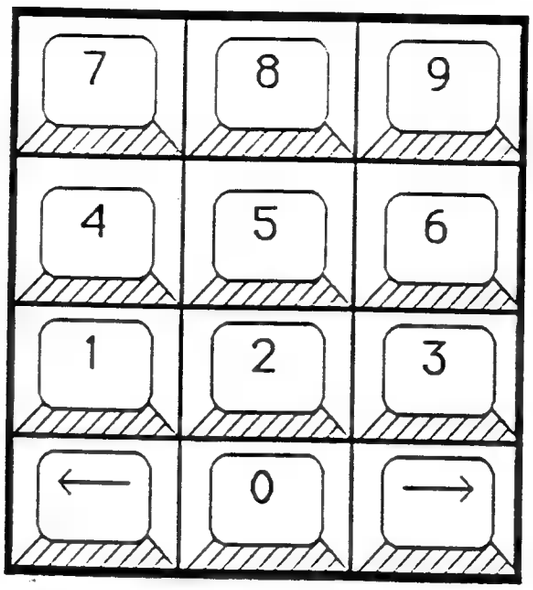
SPL: split point of the keyboard (1-7). Note that there are 14 user-programmable splits in all--those set for Combiprogram Group A and those set for Combiprogram Group B.

KEY: key number, sets break point by key number for split points 1-7 (0-61).

DTF: data-transfer mode, used to store data per function listed on front panel.

There are two ways to move the cursor in order to select new parameters. The first involves using the **arrow keys** located on the **numeric keypad** to the right of the display.

NUMERIC KEYPAD



USE THE LEFT ARROW KEY TO MOVE CURSOR TO THE LEFT

USE THE RIGHT ARROW KEY TO MOVE THE THE CURSOR TO THE RIGHT

The other way to move the cursor is to use the buttons on the **Display-Select keypad.** These are used both to access different functions, like the sequencer, analog display, digital display, tuning display, and so on, and to move the cursor to specific locations instantaneously, we'll explain more about that in a second.

For now, take a few minutes to practice moving the cursor around with the arrow keys. Notice that when you move the cursor to the left in the **Combiprogram Display,** it not only jumps to the top line, but as you continue to step the cursor to the left, the number that's next to the abbreviation **GP:=aBK:--**the **Bank Basis number--**will jump from 0 to 7, as long as you don't have any keyboard splits setup in either the Group A or Group B keyboard arrangement (see page 24 for details). As you move the cursor to the left the number goes 6, 5, 4, 3, 2, 1, 0. Try moving it back to the right. The **Bank Basis number** will go the other direction (0, 1, 2, 3.

. . .). If you do have keyboard splits set, the only way to enter new **Bank Basis numbers** is to enter them with the numeric keypad.

The **Bank Basis number** is used to indicate the number of the bank that's assigned to the keyboard when you're in KEYBOARD MODE 0 (all eight voices assigned to one sound over the entire keyboard simultaneously). If you have any splits assigned to the keyboard, the **Bank Basis number** indicates the first bank assigned to the keyboard split locations. Banks are assigned to split locations in consequtive order (see page 14 for details).

In layering keyboard modes (1-3), the Group A and B Basis Bank numbers determine which soundprograms are sounded simultaneously when a key is depressed.

The Main Display. If you keep moving the cursor all the way to the far left, under the 0 next to **CP:**, you'll find that it won't move any farther in that direction.

Moving the cursor all the way to the right of the bottom display line will cause the display to jump from the **Combiprogram Display** to the **Main Display,** which looks like this:

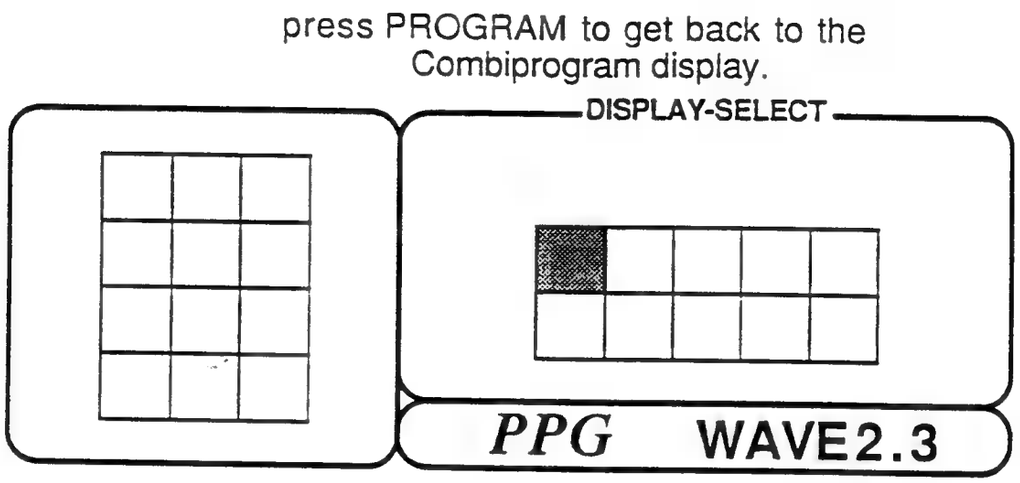
```
PROG: 62 WAVETB:14  MIDI:0  DTF:0  SPLIT:0
KEYB: 0 TTUNE: 440 CASS: 0  PPG-WAVE 2.3 V5
```

Those of you familiar with the Wave 2.2 will recognize this as being almost identical to the 2.2's Main Display, which is visable on power up of that instrument.

Changes made in the **SPLIT, KEYB,** and **MIDI** functions of this display will have an extreme effect of the operation of the Combiprogram Display, so for now, be sure not to make any changes whatsoever in this display! We'll talk about this display when we describe how to put the 2.3 into 2.2 mode on page 40.

Exit this display--you'll find that moving the cursor back to the left has no effect. Moving it all the way to the right of the bottom line will simply cause the cursor to cycle back around to the top line.

To exit the Main Display and get back to the Combiprogram Display, you have to press the button labeled **PROGRAM** at the right of the numeric keypad on the **Display-Select keypad.**



USING THE COMBIPROGRAM DISPLAY TO CALL UP SOUNDS

Combiprogram Banks & Bank Basis Numbers. You may have noticed that moving the cursor to the left of its original position under the **Bank Basis number**--the number next to **GR:=aBK:** in the Combiprogram Display--changes the sound allocated to the keyboard.

This is because moving the cursor is one way to step through the sounds loaded into the Combiprogram **Banks**--eight memory locations that hold any of the 86 soundprograms. These soundprograms are displayed next to the **BK:** (for Bank) in the top line of the Combiprogram Display.

Another way to access the sounds in these Banks is as follows:

1. **Position the cursor under the Basis Bank number** (next to **GP:a=BK:** or **GP:b=BK:**).

2. **Enter any number between 0 and 7 using the numeric keypad.** You've just called up a new sound. Play the keyboard to hear it.
   Entering an 8 or 9 will simply call up the sound in Bank 7.

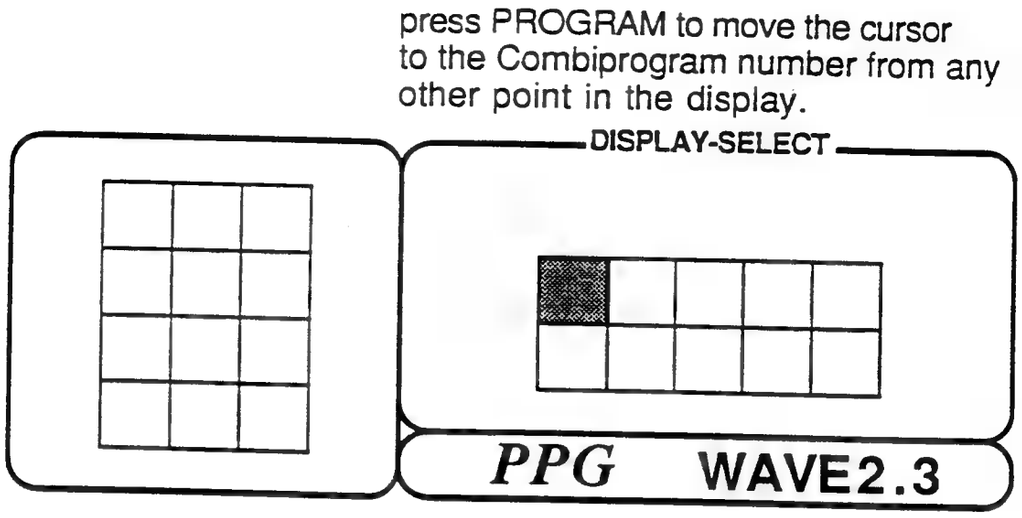
You can always access any of the eight Banks in the current Combiprogram in this way.

Combiprograms are sets of eight soundprograms which can be assigned to the keyboard simultaneously by setting up to seven split points. There are two sets (A and B) of keyboard arrangements, consisting of split points and sounds assigned to those split points. These two keyboard arrangement sets, called **Group A** and **Group B**, are accessed from the **GROUP** button on the **Display-Select keypad**. There are 20 Combiprograms (numbers 00-19).

To hear the factory-supplied Combiprograms:

1. **Press the PROGRAM button on the Display-Select keypad.** This button will always return you to the Combiprogram Display with the cursor parked under the Combiprogram number.

2. Enter any 2-digit number between 00 and 19.



After you've entered a 2-digit number to select a Combiprogram, it will take a couple of seconds for the PPG to load the **Banks** with the appropriate soundprograms for the selected Combiprogram. (You'll see the cursor step through the banks as the soundprograms load up as it did on power-up.) After this, you'll be able to play the Combiprogram you selected.

SETTING UP KEY SPLITS

Soundprograms loaded into the Combiprogram banks can be assigned to keyboard split points. Here's how:

Up to seven key splits can be set in **Group A**. Another group of seven that are completely independent of the first can be put into split locations in **Group B**. A split point can be located anywhere on the keyboard. Each successive split point has to be higher than the last.

Voices are allocated to split points dynamically, so that you never have to worry about assigning enough voices to any given split. If you play eight notes in the first split region, eight notes will sound. Likewise, if you play four notes in another split region and play four in another, they will all sound--up to the maximum of eight notes. Anything number of notes beyond eight, and the excess voices simply will not sound.

Those of you familiar with the Wave 2.2 should note that Group A and Group B have different functions on the Wave 2.3.

To set your own Group A split points:

1. **Position the cursor next to GP:a=BK: and enter the number of the Bank that holds the soundprogram that you want to assign to the lowest region on the keyboard.** If you want to use all eight soundprogram Banks, select the first Combiprogram Bank by entering a 0 next to GP:a=BK: This is because soundprograms are assigned to split locations in successive order (more on that in a minute).

2. **Move the cursor under the 0 next to SPL#1 KEY:**

3. **Enter a key number higher than 0 (0 indicates no split).** For your first try, put in 12 (using the numeric keypad). Each key (white and black), starting from the lowest C , counts as one number. Entering 12 will indicate that the soundprogram in BANK 0 will be assigned to all the notes up to and including the B above the lowest C . Until you enter another split, all the notes above the B will be assigned to bank number 1. (Remember numbers have to have two digits, so if you want a key number that's less than 10, enter a 0 before it: i.e. 01, 02, 03, and so on.)

4. **Move the cursor under the 1 next to SPL#: and press 2 on the numberic keypad to tell the instrument you want to enter the second split point.**

5. **Move the cursor back under the KEY: number and enter a 2-digit number where you'd like the second split point to occur. The instrument will not allow you to enter a number that's smaller than the previous split point number.**

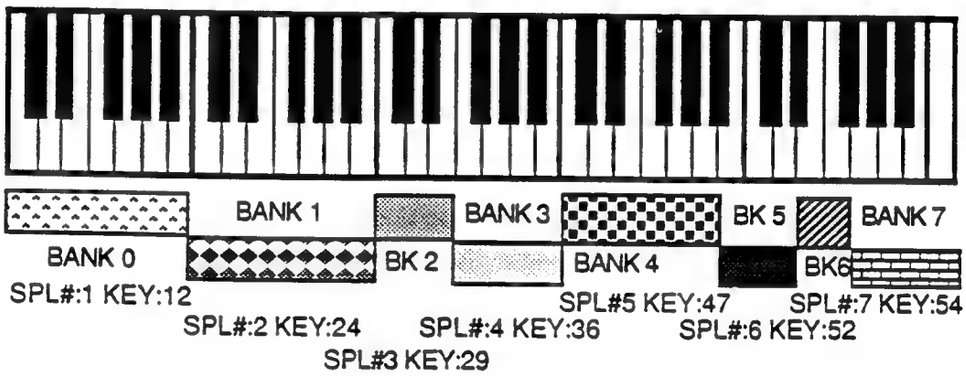
6. **Continue until you've created the number of split points you want up to the maximum of seven.**

Notice that when you entered the second key split, there were three sounds allocated to the keyboard. These three sounds correspond to the first three sounds in the currently selected Combiprogram Bank. If you entered any other number besides 0 as the BANK BASIS number in the space next to **GR:a=BK:**, it would be the first sound allocated to the keyboard.

For example, say you select Bank 2 instead of Bank 0 (so you see **GR:a=BK:2**). With splits assigned at keys 12 and 24, the sound in Bank 2 will be heard in the first octave of the keyboard. The sound in Bank 3 will be in the second octave, and the sound in Bank four will be heard over the remainder of the keyboard.

The ramification of setting the Bank to anything other than 0 is that the number of sounds assignable to the key splits goes down. In other words, with Bank 0 selected (**GR:=aBK:0**), all eight Banks can be assigned to key splits. With Bank 1 selected (**GR:=aBK:1**), seven Banks (1-7) can be assigned to key splits. If Bank 2 is selected (**GR:=aBK:2**), Banks 2-7 are available to the key splits. And so on.

This diagram should help you visualize how soundprograms are distributed across the keyboard using splits:



EACH SHADED RECTANGLE REPRESENTS A DIFFERENT SOUNDPROGRAM (ONE OF EIGHT COMBIPROGRAM BANKS). THE POSITION OF EACH RECTANGLE CORRESPONDS TO THE KEYS IT IS ASSIGNED TO BY THE SPLIT POINT SETTINGS SHOWN.

Try loading in the splits shown above to hear as well as see the way they work.

Now change the 0 next to **GP:a=BK:** to a 1 and listen to what happened to your splits--the upper-most split location (the top six notes in our example above) will be silent. Loading a 2 in place of the 1 will mean the top two split locations will be silent. A 3 will cause the top three locations to be silent. And so on.

This is because you have seven splits (eight split locations) set up, but by changing the **Bank Basis number** next to **GP:a=BK:** you change the number of sounds available to fill those split locations.

Therefore, always be sure that the Bank number you assign to **GP:a=BK:** accomodates the number of sounds you wish to assign to split locations.

You should also be aware of the fact that once you've entered split points, you can't go back and alter them individually. So, for example, you can't go back to split #5 and change it from key #42 to #43. If you want to do that, you have to load in all the splits again.

Anytime you want to eliminate all the split points, simply enter Key #00 at Split #1.

One more thing--When you assign sounds in the Combiprogram Banks to split locations, the lowest note of the keyboard region the sound is assigned to will correspond to that note in the lowest octave of the keyboard. Therefore, sounds will be transposed down by octaves the higher you assign them to split regions. For example, in our set of splits described above, the sound in Bank 1, which is allocated to the second octave of the keyboard, will sound as it would in the lowest octave of the keyboard prior to being assigned to a split location.

If you want to transpose sounds up to different octaves, or any other interval, use the **Tuning Display,** described on page 33.

GROUP B KEY SPLITS

As we've mentioned, there are two groups of keyboard arrangements stored in each of the 20 Combiprograms. A keyboard arrangement consists of key splits and soundprograms allocated to those splits; the latter is determined by the **Bank Basis number** entered next to the abbreviation **GP:a=BK:** or, if **Group B** is selected by pressing the **GROUP** button on the Display-Select keypad, **GP:b=BK:**.

Group A and **Group B** split points are completely independent. This means that you can use **Group B** to call up a different keyboard arrangement than those set by **Group B** by assigning different split locations and setting a different **Bank Basis number.**

Use the exact same procedure for loading split points and Bank Basis numbers as outlined above for Group A. However, because of system limitations you cannot use Bank 0 as a Bank Basis number in Group B.

To set up **Group B key splits** and **Bank Basis number:**

1. **Press the GROUP button on the Display-Select keypad to select Group B (so GP:a=BK: reads GP:b=BK: to indicate Group B has been called up).**

2. **Move the cursor over to the number next to KEY:**

3. **Enter the key number corresponding to where you want the first key split.**

4. **If more key splits are desired, move the cursor under the number next to SPL# and enter a 2.**

5. **Move the cursor back under the KEY: number and enter the next split value.**

6. **Repeat the last two steps until you have the desired number of splits.**

7. **Move the cursor under the Bank Basis number and enter a number between 1 and 7, corresponding to the Bank you want to be assigned to the lowest split point.** Remember that the sounds in the Banks are assigned to split locations in consecutive order.

LAYERING

So far, we've been working in **Keyboard Mode 0,** displayed in the Combiprogram Display as **KBM:0. Keyboard modes** determine how voices are allocated to soundprograms. **Keyboard Mode 0,** which is listed in the **Keyboard Modes table** to the left above the **Display Window** as **Poly 8 x 1--eight** voices to one

soundprogram--causes one sound to be assigned to all eight voices if no keyboard splits have been set. If there are keyboard splits, then one sound per split location will be heard.

In 2.3 mode, there are three other active Keyboard modes (1, 2, & 3). **Modes 4-8** are not active in the Combiprogram Display. **Modes 1, 2, and 3** allow you to layer soundprograms, that is, when you play one key, two soundprograms will be sounded.

Which two sounds are heard is determined by the **Basis Bank number** you have set for **Group A** and **Group B.** Use the method for setting the **Basis Bank number** we described on page 9.

To setup a layered sound:

1. **Press the KEYB. button on the Display-Select keypad to position the cursor under next to KBM: in the Combiprogram Display.**

2. **Enter a 1, 2, or 3 using the numeric keypad.** The **Keyboard Mode table** to the upper left of the LCD display lists how the voices are allocated to soundprograms in the various Keyboard Modes.

   In Keyboard Mode 1 (Quad 4 x 2), four voices are allocated to the Group A sound and four are allocated to the Group B sound. In this mode, you can play a maximum of four notes simultaneously.

   In Keyboard Mode 2 (Duo 2 x 4), a maximum of two notes can be played simultaneously. Four voices are allocated to each Group Basis Bank-determined soundprogram; however, each key you depress will trigger four voices--two allocated to the Group A sound, and two allocated to the Group B sound. Use this mode when you want a thicker texture.

   In Keyboard Mode 3 (mono 1 x 8), only one note can be played at a time (the keyboard will be multiple-triggered, last-note priority), however, and all eight voices will be triggered by that one note. However, four voices will play the Group A soundprogram and four voices will play the Group B soundprogram. If you want to get a really thick unison sound,

set the Basis Bank number for both Group A and Group B to the same soundprogram, but remember that you can't use Bank 0 as the Basis Bank in Group B.

COMBINING LAYERS AND SPLITS

If you enter one of the layered **Keyboard modes** with split points allocated to the keyboard, you will hear the Group A and Group B sounds layered together. However, when you cross a keyboard split point, the soundprograms you hear will be the next two over from those set by the Group A and B **Bank Basis numbers.**

The following will allow you to hear what happens:

1. **Enter a split point in the Combiprogram display by moving the cursor next to KEY: and entering a number between 1 and 60.** For this example, try 24.

2. **Press KEYB. on the Display-Select keypad to move the cursor to the Keyboard mode function, and enter 1, 2, or 3.** For this example try 1. This selects one of the layered modes.

3. **Enter different Bank Basis numbers for Group A and Group B.** For this example, enter 1 for the Group A Bank Basis number. Enter a 2 for the Group B Bank Basis number.

4. **Play the keyboard to hear how the layers are affected by the split.** In this example, playing in the lowest two octaves of the keyboard will sound Group A's Bank 1 and Group B's Bank 2 simultaneously. Playing notes above the split point will sound Group A's Bank 2 and Group B's Bank 3.

LOADING COMBIPROGRAM BANKS

You can load your own sounds into the Combiprogram Banks using this simple procedure:

1. **Position the cursor under any of the two-digit numbers next to BK: in the top line of the display.** These numbers represent the soundprograms located in each of the eight Combiprogram Banks.

CP: 0 **BK:31a10a 37a 43a 57a 47a 61a**
GR:a=BK:0 DET:0 KBM:0 SPL#:1 KEY:0 DTF:0

2. **Enter any 2-digit number (using the numeric keypad) from 00-86.**

You'll be able to play the new sound as soon as you load it.

Remember that Combiprogram **Group A** and **Group B** are totally independent of each other. Splits you load into **Group A** locations will not be remembered in **Group B** locations and vise-versa. Also, splits in either GROUP will not be stored in memory unless you use the **Data-Transfer** function to store them.

CAUTION!

We're going to be changing what's in memory, so be sure you've stored the data cassette with the factory presets on it in a safe place in case you should want to retrieve any of the sounds at a later date.

STORING COMBIPROGRAMS AND SPLIT POINTS

To store a set of split points along with an arrangement of soundprograms in the Combiprogram Banks, do the following:

1. **Enter a set of split points and/or soundprograms in the Combiprogram Banks.** If you haven't found a set of soundprograms you want to store, just enter the split points from the above example for your first try.

2. **Move the cursor over to the 0 next to DTF:** This stands for Data-Transfer. A quick way to move the cursor to the Data-transfer parameter is to push the button labelled **DATAT.** on the Display-Select keypad.

3. **Enter a 9 from the numeric keypad.** You can see that 9 = STORE in the chart just above the words Data-Transfer Modes at the lower right of the display window.

At this point, the PPG is waiting for you to enter a Combiprogram number before it will store any information in its memory.

1. **Move the cursor back to the Combiprogram number.** Remeber you can either use the PROGRAM button or the arrow keys to move the cursor to this location.

CP: 0 BK: 31a 10a 22a 37a 43a 57a 47a 61a
GR:a=BK:0 DET:0 KBM:0 SPL#:7 KEY:54 **DTF:9**

2. **Enter a 2-digit number between 00 and 19. Be sure the number you enter corresponds to the number of the Combiprogram you want to store.**

At this point you will notice the 9 next to **DTF:** change back to **0** indicating storage is complete. To verify, load a different Combiprogram by entering a new Combiprogram number, wait for the new Combiprogram to load, then enter the number of the Combiprogram you just stored. If the key splits and soundprograms you loaded appear, you'll know you were successful. If they don't appear, try again. Correcting mistakes is one of the best ways to learn to use a complex instrument like the PPG.

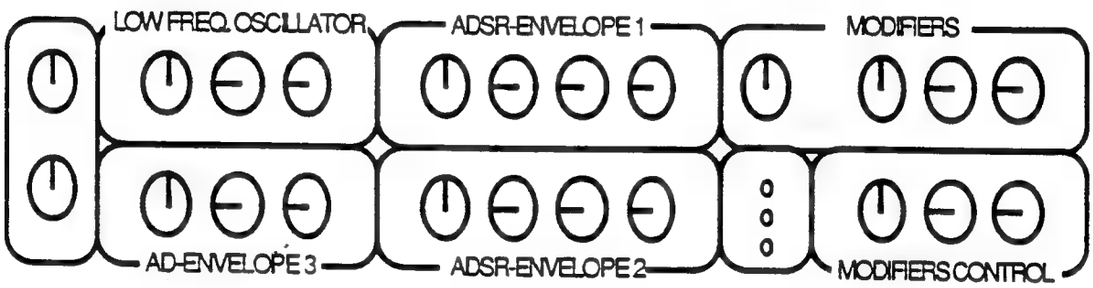
Section 2

the front panel & creating sounds

THE MULTIPLE FUNCTION ANALOG CONTROL PANEL.

In the previous section, we showed you how to call up sounds from the Combiprogram display and how to allocate those sounds to Group a and Group b variable keyboard split locations using the Combiprogram Banks. In this section, we'll show you how to alter the factory presets to your own taste, and how to program your own sounds using the **Multiple Function Analog Control Panel** located to the left of the 80-character LCD display window.

MULTIPLE FUNCTION ANALOG CONTROL PANEL



The controls in this half of the front panel are identical to those you'd find on most other programmable polyphonic synthesizers pertaining to their voice (the configuration of synthesizer components that produce the sound of the instrument).

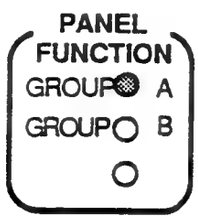
Because it is possible to allocate more than one sound to the keyboard at a time by using the Combiprogram keyboard splits and keyboard layering functions (accessed through the keyboard modes--**KBM: 0-3** in the Combiprogram display--modes 4-8 are not implemented in the Combiprogram Display, although you can use them in 2.2 mode [see page 48 for details]) as well as the sequencer's multi-timbral capability, the question arises of which sound is affected by the analog controls at any given time.

The LEDs located between ADSR-Envelope 2 and the Modifiers Control section of the Analog Panel are used to indicate which Combiprogram Group is being played when you're in Keyboard Mode 0 (**KBM: 0** in the Combiprogram Display). When the Group a keyboard arrangement is being sounded, the Group a LED will be lit. For example, say you are using factory-supplied Combiprogram 00.

You have no key splits, and you've selected Group a, Bank 2, Keyboard Mode 0. The display looks like this:

```
CP: 0 BK: 31a 10a 37a 43a 57a 47a 61a
GR:a=BK:2 DET:0 KBM:0 SPL#:1 KEY:0 DTF:0
```

The LED corresponding to the words **Group A** will be lit:



This tells you that all analog controls will affect soundprogram 37a--the sound that's in Combiprogram 00's Group A, Bank 2. If you want to modify a different sound, call up a different Combiprogram Bank by either using the cursor or entering a number between 0 and 7 next to **GP:a=BK:** as we showed you in the previous section.

To change which LED is lit and which **Group** keyboard arrangement is being sounded, press the **GROUP** button on the **Display-Select keypad** at the left of the front panel as you did in the previous section of the manual.

You'll notice that it's possible to toggle both **Group A** and **Group B** LEDs on simultaneously. When both Group LEDs are lit, the Group B keyboard arrangement is the one that's being assigned to the keyboard. However, the panel controls will affect both the Group A and Group B sounds simultaneously, regardless of the Keyboard Mode you are in.

When changing sound parameters with the Analog Panel when you have key splits set up, the panel will affect the sound you are currently playing, or if you're not playing any notes on the keyboard, the panel will affect the last soundprogram you played.

The PPG has eight voices; that is, its keyboard will sound a maximum of eight notes simultaneously. Each voice consists of two audio oscillators (the first is called the oscillator and the second is called the suboscillator on the PPG), a voltage-controlled 24dB/octave

lowpass resonant filter, a voltage-controlled amplifier, two ADSR envelope generators, an AD envelope generator, and a low-frequency oscillator. 2.3 mode allows you to alter and save every parameter except the current wavetable. This is accomplished in 2.2 mode, which we'll explain on page 40.

Those of you familiar with standard analog synthesizers will no doubt recognize the various functions represented by these controls. The panel is always active, except during those times that the processor is busy loading Combiprograms, so you can effect parameters any time the keyboard is live. Feel free to begin experimenting with the Analog Panel controls immed-iately. Even if you don't understand these functions, you won't be able to hurt the instrument by experimenting.

Modifiers. From left to right, this section of the Analog Panel holds the following:

FILTER CUTOFF CONTROL. Varies the brightness of the sound.

FILTER RESONANCE CONTROL. Adds emphasis to the frequencies located at the filter's cutoff frequency.

OSCILLATOR. Steps through the 64 waveforms in the currently selected wavetable for each voice's main oscillator.

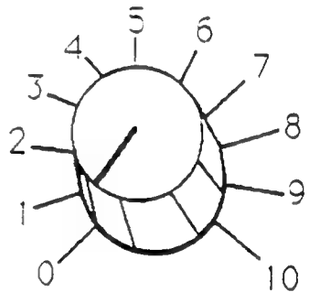
SUBOSCILLATOR. Steps through the 64 waveforms in the currently selected wavetable for each voice's second oscillator when it is switched on.

Modifiers Control. This section of the Analog Panel features three attenuators which vary the amount of modulation from the two ADSR envelope generators as they affect the filter's cutoff frequency, the volume of the VCA, and the waveforms of the first oscillator. This last control allows you to set up automatic waveform cascades.

ADSR-Envelope 1 & 2. Dual attack, decay, sustain, release envelope generators that can be used to affect dynamic changes in the filter's cutoff frequency, loudness, and sweeps of the oscillator waveforms. Setting the sustain value past xx puts the envelope generator into an unconditional mode that causes it to play through its attack stage directly into its release stage, regardless of whether a key is being held down or not. In second panel mode (explained on

page 72) these eight rotary pots are used to effect multi-parameter mixing changes in the sequencer.

AD-Envelope 3. A two-stage attack/decay envelope that can be used to control the pitch of the oscillators and suboscillators and/or sweep through the waveforms of the suboscillators. When used t control pitch, the ENV.3 ATT. (Envelope 3 attenuator) works in such a way that the 12:00 (#5) setting produces no modulation. Counter-clockwise movement (#5-0) adds negative voltage and clockwise motion (#5-10) adds positive voltage.
When the AD envelope is used to control the waveforms of the suboscillators the pot functions as a normal attenuator. 0 equals no modulation, and 10 is full modulation.



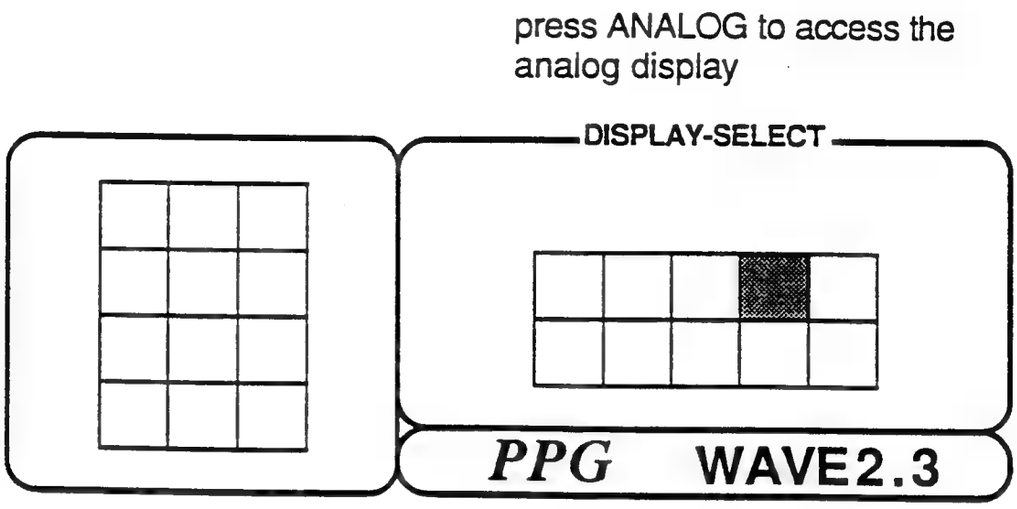
LOW-FREQUENCY OSCILLATOR. LFO rate, initial delay, and waveform controls. In second panel mode, the rate control is used to change the sequencer's playback speed.

BASIS. This single rotary control is used to adjust the width of the stereo output. This control is not programmable.

VOLUME. The master volume control. It is not programmable.

The Analog Display. One of the display pages is designed to give you immediate visual feedback on the settings of the analog controls as they are stored in memory for each soundprogram. Turning any knob on the Analog Panel will cause its corresponding numeric value in the display to jump to the new value as set by the knob. This

display is called the **Analog Display**. You access it by pressing the button labelled **ANALOG** on the Display-Select keypad.



The display window looks something like this:

```
P:  0   00 00 00   00 00 00 00   00   00 00 00
GR: a   00 00 00   00 00 00 00   **   00 00 00
```

The configuration of numbers corresponds to the way the analog control panel rotary pots are laid out. Note that the double-digit zeros shown above are only used to illustrate possible display settings. In reality, when a value is at zero, a single 0 shows in the corresponding position.

```
                LFO              ADSR-Envelope 1        Modifiers
P:  0   00 00 00   00 00 00 00   00   00 00 00
GR: a   00 00 00   00 00 00 00   **   00 00 00
    AD-Envelope 3  ADSR-Envelope 2  Modifiers Control
```

Turn any of the analog panel knobs and watch how the display changes in real time to reflect changes in the knob's postion. This will happen with all knob settings.

For example, turn the knob labelled **VCF-CUTOFF.** Notice that as you turn it, the number just above the two ** changes, indicating the new knob setting.

Using this display allows you to see as well as hear program settings.

Another way to enter parameter changes, other than turning knobs, is to move the cursor under the desired number, and then type in the new value using the numeric keypad. This method is useful for zeroing-in on precice settings once you've gotten in the general vacinity with the rotary controls.

The two abbreviations in the analog display, **P:** and **GR:**, are short for **Program** and **Group,** respectively. These are not implemented in the Wave 2.3, so their settings have no effect. (They are active in 2.2 mode, which we'll explain on page 40, and they are active when using MIDI, which we'll discuss on page 83).

The Digital Display. You may notice that adjusting some of the controls in the Multi-Function Analog Control Panel doesn't have the described effect. In fact, some controls, like those of the AD-Envelope, may not have any effect at all on some of the soundprograms. This is due to the fact that a controller (keyboard, LFO, pitch-bend and modulation wheels, and so on) has to be routed to a particular module (the filter, the oscillator waves, and so on) before the controller will be able to affect that module.

Most control routings are determined in the **Digital Display.** A few others can be set in the **Tuning Display.**

To access the **Digital Display,** press the button labelled **DIGITAL** on the **Display-Select keypad.** The display window will show something like this:

```
PROG: 62 UW0 SW0 KW0 KF2 KL4 MW0 MF0 ML0
GROUP: a BD1 BI 0 TW0 TF0 TL0 TM0 VF0 VL0
```

As in all the other displays, parameters are shown in the **Digital Display** as two letters after which values (numbers) can be added using the numeric keypad. The first two two-letter abbreviation stand for upper-waves and sub-waves. The other abbreviations represent sources and destinations. The first letter represents the source and the second the destination. The key to the sources and destinations is shown on the front panel under the display window.

Sources:

K= keyboard.
M= modulation generator (LFO).
T= touch sensor (pressure sensitivity).
V= velocity sensitivity.
B= bender (pitch-bend wheel).

Destinations:

W= waveforms.
F= filter cutoff frequency.
L= loudness.
M= modulation intensity (amount of LFO modulation).

In the **Digital Display**, routing values are entered as single numbers, so a one is entered as 1 not 01 as in other parameter displays.

PARAMETER ABBREVIATIONS IN THE DIGITAL DISPLAY.

PROG: program number. This function is not implemented in 2.3 mode except when MIDI is being used, at which point this number tells you what the currently selected soundprogram is.

GROUP: A or B. Once again, this is not implemented in the 2.3 mode.

UW: upper waves. An even number here turns the upper waves on, an odd number turns them off.

SW: Entering numbers 0-3 here affects the suboscillator.

0= Sets the waveform of the suboscillators to run parallel to that of the main oscillators. The WAVES-SUB pot on the Analog Panel is used to select the actual waveform of the suboscillators. If the WAVES-SUB pot is set to 0, the suboscillators will have the same waveform as the main oscillators.

1= Determines that the waveform of the suboscillators is only selected by the WAVES-SUB pot. This setting disables any connections that might effect waveform cascades of the suboscillators.

2= Routes AD-Envelope 3 to the suboscillator waves. Used for automatic enveloped waveform cascades.

3= Turns the suboscillators off.

KW: The keyboard controls the wavetable (0-7).

0= No effect.

1-7= Varies amount of effect. A 4 means the waveform selected by the rotary pots will sound on the lowest *C* on the keyboard. 7 produces the greatest effect.

KF: The keyboard controls the filter cutoff frequency (0-7).

0= No effect.

1-7= Varies the amount of effect. A 3 produces 100% control--one octave of keyboard changes the cutoff frequency by one octave. 7 equals a 200% effect--one octave on the keyboard produces a two-octave change of the filter cutoff frequency.

KL: The keyboard controls the loudness (0-7).

0= The lowest *C* on the keyboard produces full loudness. Playing high progressively attenuates the loudness. In order to hear this effect, turn the ENVELOPE 2 LOUDN pot full up.

4= No effect.

7= The top *C* on the keyboard produces full loudness.

MW: Routes the modulation wheel and LFO to control the waveforms. Even numbers turn it off. Odd numbers turn it on.

MF: Routes the modulation wheel and LFO to control the filter. Even numbers turn it off. Odd numbers turn it on.

ML: Routes the modulation wheel and LFO to control the loudness. Even numbers turn it off. Odd numbers turn it on.

BD: Sets the bender (pitch-bend wheel) destination--B is for bender (0-7).

0= Off.
1= Pitch of the oscillators.
4= Pitch of the suboscillators only.
5= Pitch and filter cutoff frequency.

2= Filter cutoff frequency.
3= Waveforms.
6= Pitch and waveforms.
7= Filter cutoff and waveforms.

BI: Sets the bender interval (0-3).

0= Major second.
1= Major third.
2= Fifth.
3= Octave.

When the bender is routed to control the filter and/or the waveforms, the bender interval setting adjusts the amount of the affect:

0= little change. 3= a lot of change.

TW: Routes touch-sensitivity (after-touch--effect increases as you press harder on the keyboard) to the waveforms. Even numbers turn effect off. Odd turn it on.

TF: Routes touch-sensitivity to the filter cutoff frequency. Even numbers (0-8) turn effect off. Odd (1-9) turn it on.

TL: Routes touch-sensitivity to the VCA to affect loudness. Even numbers turn it off. Odd turn it on.

TM: Routes touch-sensitivity so it controls modulation amount from the LFO. Even numbers turn it off. Odd turn it on.

VF: A remnant of an earlier version of the Wave synthesizer that is designed to mimic the effect of a velocity-sensitive keyboard from the Wave's pressure-sensitive keyboard. Even numbers turn the effect on; odd turn it off. With the effect on, the first note you play will determine the overall cutoff frequency of the filter. You may or may not hear the first note you play, since it is used as a control signal.

VL: Like VF, VL is an effect designed to get velocity-sensitive effects out of a pressure-sensitive keyboard. Even numbers turn the effect on; odd turn it off. The first note you play and hold will determine the overall loudness of the notes to follow.

Tuning the Oscillators. The only oscillator controls on the Analog Panel are the two waveform pots. Because the oscillators are digital, they never need to be adjusted. However, should you want to tune the PPG to some other instrument--such as an acoustic piano or whatever, use this simple master tuning procedure:

1. **Enter the Main Display by moving the cursor one position to the right of the data-transfer function in the Combiprogram Display The display will look like this:**

PROG: 1 WAVETB:14 MIDI: 0 DTF:0 KEYB-SPLIT: 0
KEYB:0 TTUNE:440 CASS:0 PPG-WAVE 2.3 V5

2. **Move the cursor under the second 4 in 440 next to TTUNE:** The 440 refers to A-440 Hertz.

3. **Enter a new value for the desired tuning using the numeric keypad.** Range is from 400 Hz to 499Hz. Typical range is between 440Hz and 444Hz.

The PPG will retain the last tuning value entered between power-down and power-up. So you won't have to continually readjust the master tuning once it is set unless you desire to.

The Tuning Display. If you want to detune the main oscillators in relation to the suboscillators, or if you want to transpose a soundprogram by octaves or any interval in between, you must use the **Tuning Display.**

To access the **Tuning Display,** press the button labelled **TUNING** on the Display-Select keypad. The display window will show this:

PROG: 0 DETU: 0 MO:0 MS:0 EO:0 ES: 0 BI:0
GROUP: A SEMIT: 0 0 0 0 0 0 0 0

In addition to allowing you to detune oscillators and transpose voices, the Tuning Display includes switching functions that allow you to route the LFO and AD-Envelope 3 to the main oscillators and/or the suboscillators in order to produce a variety of effects including vibrato and pitch sweeps.

As in all the other displays, modulation routing functions are shown as two-digit abbreviations. The first letter is the source of

modulation, the second letter is the modulation destination. Values are entered as numbers from the numeric keypad.

When this display is called up, the cursor is parked under the number next to PROG:, short for program. Program and Group are not implemented in 2.3 mode (although PROG is used during MIDI control to indicate the currently selected soundprogram number), so you have to step the cursor using the arrow keys to the function you wish to access.

FUNCTION ABBREVIATIONS IN THE TUNING DISPLAY.

PROG: program. Not implemented in 2.3 mode. See section on 2.2 mode on page 40 and section on MIDI on page 85 for details on this function.

DETUN: detuning (0-7). Different values entered here allow you to change the tuning of the suboscillators in relation to the main oscillators.

0= no detuning.
1= light detuning.
2= more detuning.
3= noticable detuning.
4= greatest detuning.
5= suboscillators transposed up a fifth.
6= suboscillators transposed up an octave.
7= suboscillators transposed up two octaves.

MO: Modulation from the LFO is routed to the main oscillators. Even numbers turn the routing off, odd numbers turn it on.

MS: Modulation from the LFO is routed to the suboscillators. Even numbers turn the routing off, odd number turn it on.

EO: AD-Envelope 3 is routed to control the pitch of the main oscillators. Even numbers turn the routing off, odd numbers turn it on.

ES: AD-Envelope 3 is routed to control the pitch of the suboscillators. Even numbers turn the routing off, odd numbers turn it on.

BI: Sets the pitch-bend wheel interval (0-3).

0= major second.
1= major third.
2= fifth.
3= octave.

GROUP: Not implemented in 2.3 mode. See section on 2.2 mode on page 40.

SEMIT: semitone. The eight numbers shown here represent the number of semitones each of the eight voices has been transposed.

Using the TUNING DISPLAY to tranpose voices. Say you want to be able to transpose the entire keyboard so that playing middle *C* will produce the *F* a fourth above *C* , or say you've allocated some soundprograms to split locations using the Combiprogram Display (as explained on page 13) and you want to transpose those sounds by a couple of octaves. The procedure is relatively simple, however, there are a few points that must be followed exactly, otherwise you'll get some strange and unpredictable results.

1. **Using the arrow keys, move the cursor under the first number to the right of SEMIT.**

2. **Play a single note on the keyboard--the bottom *C* on the keyboard will specify no transposition; each note above that *C* will transpose the currently selected sound up by a number of semitones equal to the interval between the note you play and the bottom *C* .**

3. **Repeat the last step until you've transposed all the voices you desire to transpose. The cursor will increment itself automatically.**

4. **Make sure the cursor is moved out of the bottom line of the display--use the arrow keys if its hasn't happened automatically.**

WARNING! You must be careful to complete the last step, entering transpositions for all eight voices, before playing any notes on the keyboard, otherwise the last few voices will be transposed by the next notes you play. This leads to unpredictable voice transpositions that are confusing at best, cacophonous at worst. Of course, you can always do this intentionally to create random effects.

Another method of loading in voice transpositions is to use the numeric keypad instead of the keyboard to enter in semitone values. Here's the procedure:

1. **Position the cursor under the first number to the right of SEMIT: as before.**

2. **Enter a two-digit number equal to the number of half-steps you wish to transpose the keyboard by.** Remember that if you want a number smaller than 10 to enter a zero first, so 1 is 01, 2 is 02, and so on.

3. **Repeat these steps until all eight voices have been transposed to the same value.**

NOTE: If you have splits set up, you should always use the keypad to change the individual tunings.

When the banks are divided by splits, each split area is a different program. Simply playing a key in any split area selects a new program, and different parameter numbers will be shown in the various displays.

For example: Set up split points as shown on page 15. Play a note in one area, then select the Analog Display by pressing the ANALOG button on the Display-Select keypad. Notice the various settings. Now play a note in another split zone. The display will change by pressing ANALOG again, showing the parameters for the program in the split zone you just played.

Using the keyboard to alter the tuning in one program may actually alter the tuning in another program, so always use the keypad to change tunings when you have splits set up.

Take some time to become familiarized with changing the routings within a few of the factory presets. Turn a couple of controllers on, and listen to the effect various range settings have. Here's an example of the kind of experimentation we're talking about:

1. **Call up a soundprogram from one of the Combiprogram Banks.** For this example, try Bank 5 in Combiprogram 00, Group a--a sort of cello sound.

2. **Position the cursor under the Combiprogram number (next to CP: in the Combiprogram Display) by pressing the PROGRAM button on the Display-Select keypad.**

3. **Press 00 to get to Combiprogram 00.**

4. **Move the cursor to Bank 5 either by using the right arrow key to position the cursor directly under Bank 5, or by moving the cursor to the Bank Basis number next to GP:a=BK: and pressing the number 5 on the numeric keypad to access the sound in Bank 5.**

5. **Play the keyboard to hear what the sound is like.**

6. **Press the DIGITAL button on the Display-Select keypad to get into the Digital Display.** Now you're ready to start experimenting with assigning different controller and modulation routings.

7. **Move the cursor under TF0 using the arrow keys.**

8. **Press 1 on the numeric keypad to toggle the function on.** Now the after-touch is routed so it will affect the filter's cutoff frequency. Play a chord on the keyboard and press down hard to hear the effect it has on the sound.

Try making a few more changes. For example:

1. **Position the cursor under TL0.**

2. **Press 1 on the numeric keypad to toggle the function on.** Now the after-touch is routed so it will affect the loudness as well

as the filter cutoff. Play a chord and press down hard to hear what this combination does to the sound.

Now let's try changing the tuning of the suboscillators in relation to the main oscillators.

1. **Press the TUNING button on the Display-Select keypad to get to the tuning display.**

2. **Move the cursor under DETUN.**

3. **Press 5 on the numeric keypad to transpose the suboscillators up a fifth.**

4. **Play the sound to hear the change--there isn't any, right? Before going any further, try to figure out why. Correcting problems is one of the best ways to learn a new instrument.**

Okay. Here's why there's no change:

1. **Go back to the Digital Display by pressing the DIGITAL button on the Display-Select keypad.** Notice that there is a 3 next to SW. Looking back at the chart on page 23, you'll notice that a 3 in this location indicates that the suboscillators are turned off! Of course you won't hear them transposed up a fifth.

2. **Enter 0, 1, or 2 to turn the suboscillators on.** Notice that if you entered a 0 there is a high pitch as well as a fifth in the sound. This is caused by the waveform of the suboscillators, which is being controlled in parallel to that of the main oscillators. If you want to get rid of that high pitch, or at least make it almost inaudible, you should try turning the **WAVES-SUB** control in the **Modifiers** section of the Analog Panel to change the waveform of the suboscillator until the pitch goes away.

Try a few more routings on your own. If you come across a connection that doesn't appear to have any effect, try to track down the reason why by refering to the settings of all the values in both the **Digital** and **Tuning Displays.** Remember the **VF** and **VL** parameters in the **Digital Display** are parameters that are left over from an earlier incarnation of the Wave, and are best ignored.

SAVING UPDATED SOUNDS.

Should you modify and alter a factory preset in such a way that you wish to replace the factory preset with your new sound, there's an easy way to store it in the PPG's soundprogram memory. But remember--*you will be replacing the factory preset.* The only way to get it back will be to use the cassette interface in order to reload all the factory presets from the data cassette that was shipped with your instrument (for details see page 89).

Essentially, soundprograms are saved the same way we showed you how to load Combiprograms back on page 12.

1. **Press DATAT. on the Display-Select keypad to get back to the Combiprogram Display with the cursor parked under the Data-Transfer function.**

2. **Press 9 on the numeric keyboard to tell the Wave 2.3 that you want to record (or store) the current Combiprogram including whatever changes you've made in the presets.**

3. **Press the PROGRAM button on the Display-Select keypad to move the cursor to the Combiprogram number.** At this point, the instrument is waiting for you to enter a Combiprogram number in order to store whatever key splits or updates you've made to any of the preset soundprograms.

4. **Enter the Combiprogram number you desire to store the changes in.** It is imperative that you be sure that the Combiprogram number you enter is the Combiprogram number you want to replace. If you've only made a few changes one of the soundprograms, don't worry, you won't be undoing anything but those changes.

In case you aren't sure you want to make the changes permanent, you should know that the PPG will always remember the last settings you had for any of the soundprograms in the Combiprogram Display until the instrument is powered down.

WAVETABLES & 2.2 MODE.

As mentioned, the only voice parameter you can't alter in 2.3 mode is the **Wavetables** used to supply the waveforms of any given sound. To get into the **Wavetables**, you have to put the instrument into 2.2 mode. Don't worry, it's not as hard as it sounds. In fact it's very simple to do.

To change to 2.2 mode, do the following:

1. **Press the DATAT button on the Display-Select keypad to return to the Combiprogram Display with the cursor parked under the Data-Transfer function.**

2. **Press the right arrow key on the numeric keypad once, so the display shows the Main Display:**

PROG: 1 WAVETB: 15 MIDI:0 DTF:0 SPLIT: 0
KEYB:0 TTUNE:440 CASS:0 PPG-WAVE 2.3 V5

3. **Position the cursor under the 3 in WAVE 2.3.**

4. **Enter a 2 with the numeric keypad.**

You will notice R/,T appear for about half a second at the bottom right of the display, after which the cursor will return to the number next to **PROG**. And where the display read **WAVE 2.3**, it now says **WAVE 2.2**. This tells you the instrument has been put into 2.2 mode.

What's that mean? Those who are familiar with the 2.3's predecessor, the Wave 2.2, will note that in 2.2 mode, the Wave 2.3 behaves exactly like a Wave 2.2. You will not be able to access any Combiprograms or other 2.3 functions in 2.2 mode. This has some rather drastic effects on some of the various display functions, and minimal effect on others. A break-down of the different functions in 2.2 mode follows the discussion of the Wavetables.

The Wavetables. The most significant difference between the 2.2 and 2.3 modes is the fact that 2.2 mode allows you to get your hands on the instrument's 32 **Wavetables**--collections of complex

waveforms produced using additive synthesis techniques and stored in the PPG's permanent memory.

Where a typical analog synthesizer might supply three or four waveforms--sine, sawtooth, square or pulse, and triangle--the PPG's Wavetables each hold 64 waveforms and a special set of waveforms called the **Upper Waves.**

The **Lower Waves** are waveforms 00-63. **Upper Waves** are waveforms 64-127.

Each Wavetable's **Lower Waves** hold different sets of waveforms, whereas the **Upper Waves** contain the same set of waveforms in each Wavetable except number 31, which is unique because it holds only two waveforms--8-bit samples of a piano and a saxophone, more details on this in a minute.

The main difference between the **Lower** and **Upper Waves** is that the **Upper Waves** are quite discontinuous. Each waveform is radically different from those immediately surrounding it, whereas many of the **Lower Waves** are organized in the Wavetables in such a way as to make it possible to get nearly smooth transitions between one waveform and the next. Sweeping the **Upper Waves** produces some rather extreme effects, where sweeping the **Lower Waves** in a number of the Wavetables produces almost filter-like effects. Of course, some of the **Lower Waves** are organized into Wavetables that are intentionally discontinuous.

A complete listing of all the 1,800+ waveforms would be impractical; however, there is a generalized break down of suggested applications for each wavetable on page 55.

One feature all the Wavetables have in common is that waves 60-63 are identical in each of the Wavetables. They hold the traditional analog waveforms:

60= triangle.
61= pulse.
62= square.
63= sawtooth.

These same waveforms are also located in the Upper Waves in Waveforms 124-127.

Accessing Upper Waves. You may have noticed that it is impossible to get either of the waveform controls on the Analog Panel to go higher than waveform 63 (to see what we mean, call up the Analog Display by pressing the **ANALOG** button on the **Display Select keypad**, turn both oscillator and suboscillator waveform controls fully clockwise, and notice that the numbers corresponding to the waveform values in the Analog Display only go to 63).

One way to access the **Upper Waves** is to simply toggle them on in the Digital Display:

1. **Press the DIGITAL button on the Display-Select keypad to access the Digital Display.**

```
PROG: 62 UW0 SW0 KW0 KF2 KL4 MW0 MF0 ML0
GROUP: a BD1 BI 0 TW0 TF0 TL0 TM0 VF0 VL0
```

2. **Move the cursor under UW0.**

3. **Enter a 1 with the numeric keypad to toggle the Upper Waves on.**

This adds a value of 64 to the current value of the waveform number. For example, with the **Upper Waves** toggled on, waveform 00 is actually waveform 64 (00 + 64 = 64). Likewise, waveform 63 becomes waveform 127 (63 + 64 = 127), waveform 42 become waveform 106 (42 + 64 = 107), and so on.

The other way to access the **Upper Waves** is to drive the waveform number past 63 by "over-modulating" the sum of the basic waveform number set by the waveform controls (**WAVES-OSC** and **WAVES-SUB**). This is accomplished when you sweep the waveforms with any of the possible modulation sources, which are:

1. **Keyboard pressure-sensitivity.** Set by TW in the Digital display, which routes keyboard pressure-sensitivity to control the waveform. It adds anywhere from 0-127 to the basic value of the waveform.

2. **The LFO.** Set by MW in the Digital Display, which routes the LFO to control the waveform. It adds and subtracts up to 32 to the basic waveform number.

3. **The keyboard.** Set by KW in the Digital Display, which routes the keyboard to control the waveforms. The range is variable. A 4 entered next to KW will add from 0 to 60 to the basic waveform number; a 7 will add from 0 to 120 to the basic waveform.

4. **ADSR-Envelope 1.** Amount set by the attenuator in the Modifiers Control section of the Analog Panel. Adds from 0 to 63 to the basic waveform value.

5. **Pitch-bend wheel.** When the destination of the bender is set to either 3, 6, or 7 in the Digital Display (BD3, 6, or 7). The range is determined by the setting next to BI (bender interval).

Should the value of the basic waveform number be driven over 127 (which is possible when you apply enough modulation), the waveforms will "wrap around," that is, start back at 00 again.

The way the suboscillator will behave when the main oscillator's waveforms are being controlled is determined by the subwaves (**SW0-3**) setting in the **Digital Display.**

The effects of those settings is as follows:

SW0= Both main and suboscillator waveforms will be controlled by whatever modulation sources have been routed to the waveforms (see above). The basic waveform number of the suboscillator is determined by the setting of the **WAVES-SUB** control on the Analog Panel, so the suboscillator can be set to a different basic waveform number than the main oscillators, but it will still be swept in parallel as the main oscillators by whatever modulation sources you assign to control the waves.

For example, say you are controlling the waveforms of both oscillators with ADSR-envelope 1. The main oscillators are set to a basic waveform number of 21. The suboscillators are set to a basic waveform number of 43. When swept by the envelope, which for this example we'll say is set to maximum effect (a range of +63), the main oscillator waveform will be swept into the Upper Waves (21 + 63 = 84), whereas the suboscillator waveform will be swept up to Upper Wave number 106 (43 + 63 = 106).

If you want the suboscillators to have the same waveform as the main oscillators and therefore be swept identically, set the basic waveform of the suboscillators to 00.

SW1= The suboscillator waveforms will be unaffected by any modulation sources routed to the oscillator waveforms--the main oscilators still be affected.

SW2= Routes AD-envelope 3 to control the suboscillator waveforms. The WAVES-SUB pot still sets the basic waveform number, but the ENV. 3 ATT. determines the upper range of modulation. With this setting, the suboscillator waveforms will be swept independently of the main oscillator waveforms.

SW3= Switches the suboscillator waves completely off. This mode is used in conjunction with the Waveterm when you want to playback a sampled sound without modifying it in any way. It is also used when you want to play a synthetic Wave 2.3 sound without any detuning or phase shift whatsoever. Even if you set the DETUNE function (in the TUNING DISPLAY) to 0 (off), there will be a static phase shift between oscillators. This will cause each of the eight oscillators to have a slightly different timbre. Use SW3 if you don't want this effect.

One more item we should point out about controlling the suboscillator waveforms with AD-envelope 3: the envelope attenuator (ENV. 3 ATT) functions differently when used as a pitch envelope and when used as a suboscillator waveform envelope.

As we mentioned briefly back on page 24, when AD-envelope 3 is used to control the pitch of the oscillators, the 12:00 position (a setting of 5) is equal to no modulation. Settings from 5 to 0 produce negative voltage sweeps and setting of 5-10 produce positive sweeps.

When AD-envelope 3, however, is used to sweep the waveforms of the suboscillators, the attenuator functions normally. A setting of 0 equals no modulation. Settings between above 0 up to 10 increase the modulation effect.

Caution: When using the Combiprogram display, the Upper Wavetable is only defined in Bank 0. The Upper Waves in Banks 1-7 are random samplings of waveforms, which means that you won't be able to count on which wave will be sounded in the Upper Waves at any time, so one soundprogram can sound eight different ways when you load it in all eight Banks.

THE FUNCTION OF THE DISPLAYS IN 2.2 MODE.

While all the displays you'll be able to access in 2.2 mode are available in 2.3 mode, a few of the functions differ between the two modes. As we've mentioned, 2.2 mode is mainly used to set up sounds for use with the 2.3 mode enhanced performance functions, available through the Combiprogram Display.

Rather than rehash every aspect of each display in 2.2 mode, and since many functions are identical between 2.3 and 2.2 modes, we'll try to keep the following discussions limited to those functions that are unique to the 2.2 mode.

The Main Display. In 2.2 mode, the **Main Display** will appear exactly as it did in 2.3 mode, however, there are a number of significant changes in the display functions. The **Main Display**, again, looks like this:

```
PROG: 1  WAVETB: 15 MIDI:0  DTF:0 SPLIT: 0
KEYB: 0 TTUNE: 440 CASS: 0 PPG-WAVE 2.2 V5
```

2.2 mode affords access to 174 soundprograms, arranged in two groups of 87 (numbers 00-86) -- **Group A** and **Group B.** Both Groups are independent of each other, with the exception that they share the same Wavetable (although the selected waveform numbers can be different between the two groups).

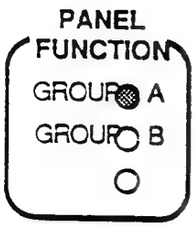
Do not confuse these groups with the 2.3 mode's **Group A** and **Group B** Combiprogram keyboard arrangements-- the term **Group** has an entirely different meaning in 2.2 mode.

As you've no doubt gathered, you call up soundprograms in 2.2 mode by simply moving the cursor under the number next to **PROG:** and entering the number of the soundprogram you want. **Soundprogram numbers** range between 00 and 86.

To move the cursor to this **Program number** in any of the 2.2 displays instantly, press the **PROGRAM** button on the **Display-Select keypad.**

Accessing Group A and B sounds. Use the **GROUP** button on the **Display-Select keypad** to determine which of the two available soundprogram groups you listen to or modify in the 2.2 mode.

The **Group LEDs** located on the **Analog Panel** indicate which group of soundprograms is currently being accessed or modified.



When the **Group A** LED is lit, the Group A soundprogram is loaded into the PPG's working memory, which means that any changes you make using the Analog Panel controls will affect only the currently selected Group A soundprogram, irrespective of the Keyboard Mode you're in.

If the **Group B** LED is lit, you'll be able to affect it.

If both LEDs are lit, both groupd are affected identically by any changes you make using the Analog Panel controls, regardless of which one is being sounded.

Now you're wondering how the heck do you determine which LED is on. This is done using the **GROUP** button on the **Display-Select keypad.** When first powered up, the **Group A** LED will be lit. Press the **GROUP** button on the **Display-Select keypad** to cause the **Group B** LED to light. Press the **GROUP** button again to toggle both LEDs on. Press the **GROUP** button once more to light the **Group A** LED.

If you are in **Keyboard Mode 0**--all eight voices assigned to produce the currently selected soundprogram (so the keyboard will only play with one single timbre)--the currently lit LED indicates which soundprogram is being sounded by the keyboard. However, when both **Group** LEDs are lit, only the **Group B** sound will be heard. With any other **Keyboard Mode** (1-8), both **Groups** are sounded, irrespective of which LED is lit. In this case, the LED is simply indicating which sound is being affected by the Analog Control Panel.

We recommend that you always edit or alter sounds with the keyboard set to Mode 0, since this will avoid possible confusion as to which sound you are actually changing with the Analog Controls.

As it does in 2.3 mode, the **Second Panel LED**, located beneath the two Group LEDs, is used to change the function of the Analog Controls for use during Multi-Parameter Mixing with the sequencer. It is explained on page 72.

PARAMETER ABBREVIATIONS IN 2.2 MAIN DISPLAY

PROG: program. Numbers 00-86. Group A and Group B soundprograms, as described above.

WAVETB: wavetable. Numbers 00-31, as described previously on pages 32-40.

MIDI: Musical Instrument Digital Interface. Numbers 01-16 select the current MIDI channel. 00 turns MIDI off. 17 selects Mono Mode (omni off/mono, MIDI Modes 4). See page 83 for details on the Wave's MIDI implementation.

DTF: data-transfer. Numbers 0-7, 9. Like the Data-Transfer function in the Combiprogram Display, these ten settings allows you to move data around inside the instrument, store and call up soundprograms, and even erase soundprograms. See page 50 for details.

SPLIT: keyboard split point. In 2.2 mode there is only one user-programmable split point. The number entered here corresponds to the number of semi-tones from the bottom *C* on the keyboard and the location of the split. So, for example, a 12 would indicate the lower keyboard sound would be allocated to the lowest octave of the keyboard; the upper sound would go to the remaining four octaves. Group A and B sounds are allocated to the keyboard in various ways depending on the selected Keyboard Mode. Note that in 2.3 mode, SPLIT number is used to transpose sequences (see page 69 for details).

KEYB: keyboard mode. Numbers 0-8. Determines voice allocations to the keyboard. in 2.2 mode. all nine modes are available (in 2.3 mode, only modes 0-3 are possible).

0= Poly 8 x 1. Eight-voice polyphony (you can play up to eight notes simultaneously). All eight voices are allocated to the currently selected soundprogram. In this mode there is no split or layer.

1= Quad 4 x 2. Layered four-voice polyphony (you can play a maximum of four notes simultaneously). Each note you play will sound the Group A and B soundprograms simultaneously.

2= Duo 2 x 4. Layered two-voice mode. A maximum of two notes can be played simultaneously. Both Group A and Group B sounds will play simultaneously. However, each will be produced by four voices at once, which produces a fatter sound.

3= Monophonic 1 x 8. Only one note can be played at one time. Both Group A and B soundprograms are produced. All eight voices sound simultaneously. In this mode, the keyboard will be in a multiple-trigger, last-note priority mode. If you sustain notes while playing others the sustained note will not be retriggered when you lift your finger off of each new note.

4= A-Quad, B-Quad. A split mode. Soundprogram Groups A and B are allocated to four voices each. The Group A sound is assigned to the top portion of the keyboard split, while the Group B sound is assigned to the bottom portion of the keyboard split. Unlike the 2.3 mode, which dynamically allocates voices to the keyboard (assigning them as required), 2.2 mode requires you to select, via the different modes, how many voices are assigned to each section of the keyboard.

5= A-Mono, B-Quad. The upper portion of the keyboard (Group A soundprogram) is monophonic, sounding two voices simultaneously. The lower part of the keyboard (Group B soundprogram) is four-voice polyphonic.

6= A-Mono, B-Poly. The top section of the keyboard (Group A) is once again monophonic (voices 1 and 3 sound simultaneously). Group B is six-voice polyphonic.

7= A-Poly, B-Mono. The opposite to Mode 6. Group A is six-voice polyphonic. Group B is monophonic (voices 2 and 4 sound simultaneously).

8= A-Mono, B-Mono. Both portions of the keyboard will be monophonic. Each sounds four voices simultaneously. The first four voices are assinged to Group B and the second are assigned to Group A, so you can tune each voice to a note in a chord (using the TUNING Display--see page 33) and play it from one note on the keyboard. Each side of the split can be tuned to a different chord. Here's how it's done:

1. **Enter a soundprogram number.** For this example, try program 3.

2. **Enter a split point.** For this example, try 24.

3. **Put the instrument into Keyboard Mode 8 (by moving the cursor under the number next to KEYB: and hitting 8 on the numeric keypad).**

4. **Press TUNING on the Display-Select keypad to access the TUNING Display.**

5. **Move the cursor under the first number next to SEMIT.**

6. **Enter four notes of a chord, one at a time. If it helps you keep track of what you're playing, always enter a *C* as the first note of the chord.** For this example, enter four consequtive fifths--*C, G, D, A.*

7. **Repeat the previous step if you want to build a chord on the top half of the keyboard as well.**

8. **Press the PROGRAM button on the Display-Select keypad to exit the TUNING Display.**

9. **Play a few notes on the bottom and top portions of the keyboard to hear the effect.**

This same effect can be used with Keyboard Mode 3 to play parallel eight-note chords. In Modes 6 and 7, the monophonic keyboard sections can be setup to play two-note chords by transposing one of the two voices in the monophonic half of the keyboard to some interval.

TTUNE: total tuning. Identical in 2.3 mode. Allows you to adjust the master tuning of the instrument from A-400 to 499 Hertz.

CASS: cassette interface. For using the cassette interface to store data externally on data cassettes. See page 89 for details.

The Data-Transfer Functions. The Data-Transfer (DTF) parameters are perhaps the least understood of any of the PPG's many functions, yet their application is virtually indespensible for efficient use of the instrument's many capabilities.

We've already explained the simple procedure for storing sounds (see page 21). However, a glance at the front panel **Data-Transfer modes** will give you some idea that this function does a lot more than just let you store soundprograms.

Here's a breakdown of **Data-Transfer modes** and a few suggested uses:

O= Program. Use this Mode when you want to abort or cancel any other Data-Transfer. For example, say you accidentally tell the instrument you want to save a soundprogram (by entering a 9 as the Data-Transfer function), and you really don't want to put it into memory. Enter a 0 and the function will be aborted. 0 is the **Data-Transfer mode** the instrument powers-up with. This is because this mode loads the currently selected soundprogram, including Wavetable data, into the PPG's working memory, which allows that sound to be played and/or altered by the various controls.

1= A»A, B»B. The settings stored within 2.2 mode Group A and B are loaded into the working memory, minus the Wavetable number. This mode, as well as modes 2-7, is recommended for working with the Sequencer, since it allows you to set up instantaneous soundprogram changes within a sequence. Normally, when soundprograms are selected, there is about a 1/2-second hiccup in the sound as the PPG's processor loads the Wavetable information from one soundprogram to another. When the Wavetable information is not changed from one program to another, as in this DTF mode, the change in sound is instantaneous.

2= A»A. Similar to DTF mode 1, however, only the data from Group A (remember this is 2.2 mode Group A) is transferred. Group B remains unchanged.

3= B»B. Similar to DTF mode 2, except now it is the data from Group B that is transferred. Group A remains unchanged.

4= A»B. The data from Group A is copied to Group B. Group A itself remains unchanged.

5= B»A. The data from Group B is copied to Group A. Group B itself remains unchanged.

6= A»A+B. The data in Group A will be transferred (copied) onto the sounds in both Group A and Group B in the selected program destination.

7= B»A+B. Just like mode 6, only now it is the data in Group B that is copied to both Group A and Group B in the selected program destination.

9= Store. As explained on page 21, this DTF mode is used to load all information in the work memory, including Wavetable number, into the selected soundprogram number.

In DTF modes 1-7, the Wavetable, Keyboard Mode, and Keyboard Split Point data remains unchanged. Again, these modes are useful for setting up instantaneous program changes within a sequence.

Another useful application of the DTF modes to when you're working in 2.3 mode and want access to a sound that you have loaded into one of the 2.2 mode Group B soundprogram locations. Since you can only access Group A sounds in 2.3 mode, you'll want to use DTF mode 5 to transfer the data in Group B to Group A.

Here's an example of this procedure:

1. **Find a sound you'd like to transfer or copy from one location to another and call it up by entering its program number next to PROG: in the Main Display.** There is no DTF mode that allows you to perform a straight swap of Group A and B sounds, so whatever soundprogram you pick is going to have to be one you don't care about losing, since it will be written over with no way to recall it.

2. **Press DATAT. on the Display-Select keypad to instantly move the cursor to the Data-Transfer mode in the Main Display.**

3. **Enter the appropriate mode number with the numeric keypad.** In this example, select mode 5.

4. **Press the PROGRAM button on the Display-Select keypad to return the cursor to the program number function of the Main Display.**

5. **Enter the number of the program you wish to replace.** In this example, enter the same program number you started with in order to bring the Group B soundprogram into Group A.

In case you change your mind, you can abort the procedure at any time before the next step. The next step is the final one, and will permanently alter the instrument's internal memory, so be sure you really want to continue before you do so.

1. **Move the cursor back to the number next to DTF by pressing the DATAT. button on the Display-Select keypad and enter a 9 with the numeric keypad to store the soundprogram in memory.**

This procedure is identical for all of the DTF modes. The results are all that will be different between them.

The other 2.2 displays. The **Digital, Analog,** and **Tuning displays** all have the same functions in 2.2 mode as they did in 2.3 mode with the exception that the **PROG** and **GROUP** functions are active in the 2.2 mode.

The **PROG** function is identical to the **PROG** function in the Main Display. The **GROUP** function simply displays which Group, A or B, has been selected with the **GROUP** button. You'll notice that the LEDs will display the same information as the **GROUP** function letter; *i.e.* when the **Group A** LED is lit, a lower-case A (a) is displayed next to the **GROUP** function in the **Digital, Analog,** and **Tuning** displays. When the **Group B** LED is lit, or when both LEDs are lit, a lower-case B (b) will be displayed in those display windows.

When switching back and forth between Group A and B soundprograms, you'll see the parameter values change as well. This is because the displays are changing to reflect the fact that new data (from independent soundprograms) is being called up.

Remember that the above is true only in 2.2 mode.

When in 2.2 mode, the **DATAT** and **KEYB** buttons on the **Display-Select** keypad have the following functions:

DATAT. Returns the cursor to the Data-Transfer function in the Main Display.

KEYB. Returns the cursor to the Keyboard Mode function in the Main Display.

APPLICATION NOTES FOR THE WAVETABLE LOWER WAVES

Applications suggested here are only intended as guidelines. There are no hard and fast rules about using the Wavetables. We recommend you experiment as much as possible. One quick way to change the timbre of any of the factory-sypplied presets is to change its Wavetable.

WAVETABLE NUMBER	possible applications
00	Harmonics 1-8 are very strong, simulation of a resonant filter, wave number 00 is a sine wave.
01	Similar to Wavetable 00, but with additional higher harmonics, dual VCF simulation.
02	Similar to two previous Wavetables, but also good for vibes, bells, tubular bells, and so on.
03	Sine-to-rectangular sweep, low-resonance VCF simulation, clarinette and flute sounds.
04	Waves 00-47 feature very high harmonics in progressively greater amplitudes. Waves 47-59 continue to add high harmonics but at a faster rate. Also useful for delay effects and church bells.
05	Very high harmonics are emphasized, effects similar to Wavetable 15, but more mixture-like.
06	Sine-to-ramp sweep, low-resonance-VCF effects, also good for woodwinds.
07	VCF sweep without resonance, also useful for woodwind sounds.
08	Highpass VCF simulation without resonance. Wave 00 has little or no fundamental. Wave 25 has fundamental at maximum amplitude. Useful for dark percussive strings, bass with click-like attack.

09 Formants are strong middle-range harmonics, useful for ring-modulation and vocal sounds.

10 Similar to Wavetable 09.

11 Low formants. Wave 00 is dark. 32 is bright. 59 is dark.

12 High formants that sweep.

13 Very strong high-order harmonics, the fundamental is weak. Useful for bright percussive stringed keyboard isntrument sounds like clavichord, harpsichord, and so on. When swept, you get an amplitude modulation effect. Wave 00 is maximum amplitude, 24 is minimum amplitude, 59 is maximum. Use detune 4, UW0 and dissonant low chords for noise effects.

14 Several organ registers. Sine, Hammond, Lowery, Church organs.

15 Harmonics 2 + 3 to sawtooth sweep. Useful for harmonium, accordion, harmonica sounds.

16 Wild amplitude modulation effects when swept. Several peaks and dips in amplitude.

17 Wave 00 features the fundamental and second harmonic. Wave14 is the fundamental alone. Wave 40 has high harmonics. Wave 59 is the fundamental alone.

18 When swept produces high-low-high harmonic sweep effect.

19 Waves 00-32 are stationary waveforms with string upper harmonics and a few lower harmonics. Wave 59 has no fundamental.

20 Fast discrete changes of low and high harmonics for sample and hold effects. Wave 00 is a sine wave.

21 Sine wave to high frequency formants.

22 This wavetable is particularly suited for echoing effects. Waveforms vary from original attack plus one delay, to two colored delays. Wave 00 is a sine wave.

23 Strong high harmonics.

24 Stationary organs. If swept produces ascending high harmonic sweeps.

25 Waves 59 to 49 go from bright to sine wave. 48 to 33 have a colored delay. 33 to 18 are sinewaves. 17 to 00 have a colored delayed echo.

26 Variations on sawtooth waves is strong, bright formants. Good for brass sounds.

27 Formant sweeps. When keyboard is used to control the waves vocal and choir sounds can be produced.

28 Phasing sawtooth waves. Useful for ensemble string sounds.

29 Square to rectangular to narrow pulse waves. Sweeps produce pulse-width modulation effects.

30 This Wavetable was used on older Wave 2.2's when you wished to load the Lower Waves with your own sampled waveforms from the Optional Waveterm. When selected, wave numbers 00-63 retained the waveforms of the previously selected Wave-table, but the Upper Waves will be replaced by your own sampled waveforms. This function is somewhat useless in a 2.3 since any bank, regardless of the wavetable being used can accept a sampled sound from the Waveterm.

31 Another special Wavetable which holds 8-bit samples of a piano and saxophone that are self-sweeping. When using this wavetable, the WAVES MAIN and WAVES SUB controls do not work as normal. Instead, the WAVES MAIN pot is used to adjust the starting point of the sample, and the WAVES SUB control adjusts the end point of the sample.

Waves 60-63 and 124-127 are identical in all the wavetables except 31.

60= triangle. 61= pulse. 62= square. 63= sawtooth.

124= triangle. 125= pulse. 126= square/ 127= sawtooth

Section 3

the sequencer

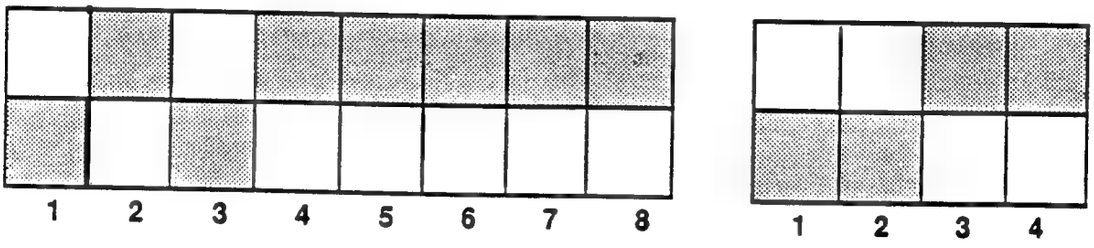
THE SEQUENCER

The PPG 2.3's built-in digital sequencer allows you to record ten sequences of up to eight independent monophonic (single-note) lines, assign any of the currently selected combiprogram's eight bank soundprograms to each voice, and perform automated mixing/parameter changes on the sequence after it has been recorded, storing these updates as part of the sequence. Polyphonic recording is achieved by assigning multiple sequencer channels to record simultaneously.

To access the sequencer from any of the 2.3's displays, press the SEQUENCER button on the Display-Select keypad. The display window will look like this:

```
PROG:01 SEQ:99 LOOPS: 0 RECM:0 TIMCOR: 0 S: 0
RUN:0 CH 1:3  2:3  3:3  4:3  5:3  6:3  7:3  8:3
```

Before we show you how to record your own sequences, there are two things we need to do. The first and most important is that you need to check the back panel's two sets of mini switches to make sure they are set properly. If they are set to anything but the configuration shown below, the sequencer won't work properly because the switches determine how the PPG's internal clock acts. If it's set to see an external clock, you won't be able to start the sequencer at all. Make sure the two dip switches look like this when initally recording sequences:



Shaded areas indicate position of switch, so 1 and 3 on the first switch block here are down, 2 and 4-8 are up.

Switches 1 and 3 on the first switch block should be down, as should switches 1 and 2 on the second switch block. All the rest of the switches should be up. This is extremely important! If the switches aren't set properly, the sequencer won't operate properly.

The rule of thumb here is that only switches 1 and 2 on the second switchblock should be on when recording. On the first switch block, if switch 1 is on, switch 2 should not be on, and vice versa. Likewise, only one of switches 3-8 should be on at any given time. We'll explain why later.

The second thing we should do is let you hear the demo sequences that come in the machine in order to give you an idea of the kinds of things you can do with the sequencer.

The PPG 2.3 gives you the ability to record ten sequences. The first eight of these (00-07) hold demo sequences, which you can erase at any time. To hear these, it is first necessary to load in the proper combiprograms. Each sequence uses a combiprogram with the same number. So, for example, sequence 01 requires that you load in combiprogram 01. Of course, your own sequences can use any combiprogram you like. We've simply used the same combiprogram number as the sequence in order to simplify the demonstration. The one exception is that demo sequence 00 uses combiprogram 10.

Demo sequences 1-7 correspond to combiprograms 01-07.
Demo sequence 0 corresponds to combiprogram 00.

To hear the demonstration sequences:

1. **Press the Program button on the Display-Select keypad and call up a combiprogram number that corresponds to the sequence number you wish to hear (00-07).**

2. **Press SEQUENCER on the Display-Select keypad to get to the Sequencer display.** The cursor will be parked under SEQ: 99. This is the Sequence number.

3. **Enter the sequence number that corresponds to the combiprogram number entered above using the numeric keypad (00-07 for the demo sequences).**

4. **Press the RUN/STOP button on the Display-Select keypad to move the cursor under the 0 next to RUN:**

5. **Enter a 1 using the numeric keypad to start the sequence. To stop it, enter 0 with the numeric keypad. If you wish to start it again from the exact point you**

stopped it at, enter a 2 with the numeric keypad, otherwise, entering a 1 again will cause the sequence to restart from its beginning. Note that sequences 1, 2, and 4 use multiparameter mixing in real time, which requires you to put the Analog Panel into second panel mode (by pressing PANEL on the Display-Select keypad), and turn the ADSR/CH controls in order to hear the sequence.

THE SEQUENCER DISPLAY ABBREVIATIONS

PROG: Program, not active in 2.3 mode.

SEQ: Sequence number (00-09) and arpeggiator mode (10-15, 21-25). Numbers entered here call up the sequences or set the arpeggiation mode.

LOOPS: Number of loops (00-98, 99). Determines the length of a sequence (a maximum of 64 metronome beats) and sets the number of times it will repeat (up to 98--99= infinite repeats). Also used to set the number of repeats for the arpeggiator.

RECM: Record mode (0, 1, 2, 3, 4, 8, 9). Numbers entered here are used to put the sequencer into record mode. Take great care not to enter an 8 here unless you really want to--entering 8 twice erases the entire sequence memory! So it's ill advised to just start putting in random numbers to see what works and what doesn't. Read the next section on recording and playing back sequences before you start experimenting, or you're liable to really bung up and erase sequences you'd rather have saved.

0= recording is off.

1= used for recording a new sequence the length of which has not been determined. Erases the previous sequence including its length. In this mode, the length is determined by pressing the RUN/STOP button at the desired end of the sequence. However, care must be taken not to overload the sequence memory. For this reason, we'd recommend that you always use RECM:4.

2= update memory. Used when an aleady recorded sequence needs to be updated using the multi-parameter mixing function. Loudness, waveform, filter cutoff, and pitch can be affected for every note and then stored using this code.

3= used for polyphonic recording, although the same effect can be optained by recording with code 4.
4= record sequences of previously determined length.
8 (entered twice)= erase entire sequence memory. After one eight is entered, the sequencer answers with ? in the display. If you want to abort erasure, enter a 0 at RECM: If EEEEEE. . . appears in the display, an error has occured, and entering 8 again will restore the sequence memory.
9= store the number of loops, the keyboard split in the Main Display, and the speed of the sequence as part of the sequence.

TIMCOR: Time correction (0-4, 8). Also known as quantization, numbers 0-4 and 8 set the number of notes per beat.

0 turns the quantizing off.
1= quarter notes (one note per metronome beat).
2= eighth notes (two notes per metronome beat).
3= eighth-note triplets (three notes per beat).
4= sixteenths (four notes per beat).
8= thirty-second notes (eight notes per beat).

S: Speed. The number entered here is roughly equal to beats-per-minute.

RUN: Run/stop condition.

0= stop.
1= start sequence from beginning.
2= start sequence from wherever it was when last stopped.
3= steps through notes individually when 3 is pressed on numeric keypad.

CH: Channel. Numbers here indicate the channel number (1-8 to the left of the colons) followed by the channel's record condition (0-8 on the right side of the colons).

0= data recorded in channel.
1= record mode.
2= erase what's recorded on that particular channel.
3= empty channel (no data in it).

4= update pitch negatively using second panel function and the two sets of ADSR controls (each knob affects one channel of the sequencer).
5= update pitch positively.
6= update loudness.
7= update filter cutoff frequency.
8= update waves.
9= update the filter attenuator that controls the amount of ADSR envelope 1 as it affects the filter cutoff.

Codes 0 and 3 are used to indicate the channel's status (data or no data present). Code 1 is for recording. Code 2 is for erasing data from a channel. Codes 4-9 are used after recording and are multi-parameter mixing functions.

Note: Channels are monophonic. You can only play single-note lines in each. If you want to record polyphonically, use RECM: 4 and enter a 1 (record mode) at enough channels to cover the number of voices you wish to play. If you decide to use RECM:1, first determine the sequence length, then enter a 1 next to enough channels to cover the number of voices you wish to play.

RECORDING YOUR OWN SEQUENCES

The PPG's sequencer requires you to define five things before you actually do any recording:

1. **Select the soundprogram you wish to record with.**
2. **Set the length of the sequence.**
3. **Set the sequencer's record mode.**
4. **Set the time correction.**
5. **Set the tempo.**
6. **Set the channel(s) record mode.**

To select the soundprogram:

1. **Press PROGRAM on the Display-Select keypad to get to the Combiprogram display if you're not already there.**

2. Select the desired Combiprogram by entering a number between 00 and 19.

3. Move the cursor over and down to the Bank Basis number next to GP: a/b and enter the desired bank number (0-7).

You are limited to recording sequences with the eight sounds in the currently selected combiprogram. Of course, changing the combiprogram will change the sounds that any given sequence will use on playback. You can assign any of the banks to any of the sequencer's channels simply by entering the appropriate Bank Basis number before you record data into the channel.

To set the length of a sequence:

1. Move the cursor under LOOPS: using the arrow keys.

2. Figure out the number of metronome beats (any number between 4 and 64) you want your sequence to be. Note: you'll always get a four-beat countdown before recording starts.

3. Enter that number next to LOOPS: using the numeric keypad.

You can have this sequence repeat up to 98 times or infinitely, so don't be afraid that you're going to be limited to sequences that are only 64 beats long. Note that you can't reset the length of a sequence once the sequence has been recorded without starting all over again from scratch.

To set the time correction:

1. Move the cursor under the 0 next to TIMECOR: using the arrow keys.

2. Enter the appropriate number using the numeric keypad. Time correction numbers are:

   0= off.

1= quarter notes (one note per metronone beat).
2= eighth notes (two notes per metronome beat).
3= eighth-note triplets (three notes per beat).
4= sixteenth notes (four notes per beat).
8= thirty-second notes (eight notes per beat).

As you might imagine, setting the length of the sequence ahead of time means that it's a good idea to know in advance what it is you're going to be recording into the sequencer.

To set the tempo:

1. Move the cursor under the number next to S:

2. Enter the appropriate tempo. Since it's possible to change the tempo after you've recorded a sequence by using the LFO RATE/SEQ. control with the second panel function on, it's a good idea to record at slow speeds and play back at faster speeds.

To set the sequencer's record mode:

1. Move the cursor next to RECM:

2. Enter a 4 to set the sequencer on record. You will notice the numbers next to LOOPS: and TIMCOR: and S: go to 0. This simply tells you that those numbers are now stored in the sequence memory, and you're ready to go on.

To set the channel(s) record mode:

1. Move the cursor down to the second line of the display and over to the number to the right of the channel you wish to record.

2. Enter the appropriate channel record mode number using the numberic keypad depending on what it is you want to record.

   1= record mode. Enter this number when recording new data into a channel. Since each channel holds monophonic lines, if you want to record chords with one timbre, enter a 1 at

enough channels to cover the number of notes you want to play simultaneously.

2= **erase mode.** Enter this number next to a channel when you want delete notes from a previously recorded sequence (see below for details).

Numbers 0 and 3 are used to indicate to you which channels are free and which channels have data in them. A 0 next to a channel number indicates that there is data present. A 3 indicates that the channel is empty and ready to be recorded in. Numbers 4-9 are used to update parameters in real time. These parameters can be stored as part of the sequence itself, but we're getting ahead of ourselves.

After the first six steps described above have been completed, you're ready to actually record some data into the sequencer. Remember, this is a digital sequencer, and you're not recording audio signals as you would on a tape recorder. Rather you're recording data that tells the PPG's internal computer what notes have been turned on and off.

Recording the sequence:

1. **After the steps above, move the cursor under the 0 next to RUN:** A quick way to do this is to press RUN/STOP on the Display-Select keypad.

2. **Enter a 1 using the numeric keypad.**

At this point you will hear a metronome ticking away. Recording doesn't begin until the first four beats--a count off--go by. For seamless looping, start playing right on the fifth beat and continue to the end of the sequence. Remember that you cannot reset the length of the sequence once it has been set initially.

Playing back what you just recorded:

1. **Press RUN/STOP on the Display-Select keypad to move the cursor under the 0 next to RUN:**

2. **Enter 1 to start the sequencer playing back.**

Here's what you do if for some reason you want to stop the sequence before it's finished playing.

Stopping sequences before they're finished:

1. **Enter a 0 next to RUN: while the sequence is playing.**

If you want to restart the sequence from the exact point you stopped it:

1. **Enter a 2 at RUN:**

If you want to restart the sequence from its beginning:

1. **Enter a 1 at RUN:**

Recording additional parts:

It isn't necessary to repeat steps 1-6 outlined above when you want to record additional parts to your sequence. All you need do is

1. **Select a new soundprogram if desired by pressing PROGRAM on the Display-Select keypad to get back to the Combiprogram display and entering a new Bank Basis number.** It is possible to use a different soundprogram on each of the sequencer's eight channels, but again, you may only use those soundprograms that are loaded into the currently selected combiprogram.

2. **Enter 1's next to the channels you want to record on.**

3. **Enter a 1 next to RUN:**

You'll hear the count off again, and the first part you recorded will playback. You can begin playing the new part immediately. To hear the new part along with the original, simply enter a 1 at RUN: as before.

If you want to add notes to an already recorded channel:

1. **Move the cursor under the channel you wish to add notes to.** Remember, you do not and should not repeat steps 1-6 before doing this or any of the next procedures.

2. **Enter 1 next to the CH numbe**

3. **Press RUN/STOP.**

4. **Enter 1 to start the sequence.**

5. **While the sequence p add the notes you wish to hear.** Remember that quant me correction) works to limit the number of notes per metronome beat, so you won't be able to add more notes than the time correction allows. However, you can change the time correction at any time, so that if you used TIMCOR:1 the first time around, you can change it to any other TIMECOR: value on the next pass. Just remember that you won't be able to add notes on beats where notes already exists, because each channel is monophonic. Of course you could add notes on other channels.

Erasing individual notes:

Should you make a mistake and want to erase a single note, a group of notes, or an entire channel, here's what you do:

1. **Enter a 2 next to the channel you want to fix.**

2. **Press RUN/STOP on the Display-Select keypad to move the cursor under the 0 next to RUN.**

3. **Enter a 1 to start the sequence playing.**

4. **Now hold down the RUN/STOP button while the sequence is playing back in order to erase all the data in the appropriate channel.** If you don't want to erase a channel in its entirety, hold down the RUN/STOP button only when the note or notes you want to erase are playing. During this procedure, you will hear the notes play back while holding down RUN/STOP; however, the next time you play back the sequence, the notes will be erased.

Erasing entire sequences:

If you decide you want to erase an entire sequence the procedure is simple:

1. **Record over the old sequence.** Do this by repeating the steps described above for recording a sequence. Namely, select a combiprogram and soundprogram, set the sequence length in number of metronome beats, set the record mode, set the time correction, set the tempo, and set the channel mode, and record your new sequence. The old one will be erased as the new one is recorded, however the length will remain unchanged if you're using RECM:4.

Erasing the entire sequence memory:

To clear the entire sequence memory, here's what you do:

1. **Make sure a number from 00-09 is entered next to SEQ:**

2. **Enter an 8 next to RECM:** The display will show a bunch of question marks (?). If you should realize you *don't* want to erase the sequence memory, you can abort the procedure at this point by entering a 0 next to RECM:

   If you *do* want to erase the sequencer's entire memory, proceed:

3. **Enter 8 next to RECM: a second time, erasing the entire sequencer memory.** If there is a number other than one between 00 and 09 (like 22 or whatever), the display will show a bunch of E's, indicating an error. If this occurs, enter two 8's next to RECM: again, and the memory will sort itself out.

Playback sequence length and speed:

You can't change the actual length of a sequence after you've recorded it without rerecording the entire sequence; however, you can cause it to loop up to 98 times, or indefinitely. This is accomplished by:

1. **Enter a number from 00-98 (corresponding to the number of times you want the sequence to loop) or 99 (for infinite looping) next to LOOPS: after you've recorded the sequence.**

2. **Enter a 1 next to RUN:** The sequence will now repeat or loop the exact number of times you told it to.

If you should stop the sequence before all the loops have been played through (by entering a 0 next to RUN:), the number next to LOOPS will show the remaining number of loops. If you should wish to restart the sequence from where it left off, enter a 2 next to RUN: If you should wish to start to sequence over from its beginning, enter a 1 next to RUN:

Storing the number of loops and tempo with the sequence:

You'll notice that entering a 1 next to RUN: after you've played a sequence through to its end does not reset the number of loops you had entered before. That's because the number of loops will not be stored automatically. To store the number of loops, not to mention the sequence tempo, with the sequence itself:

1. **Enter the desired number of loops next to LOOPS:**

2. **Enter the desired speed next to S:** For this, you can use the LFO RATE/SEQ knob on the Analog Panel, with the second panel function on, to adjust the speed of the sequence's playback until it is what you want it to be.

3. **Enter a 9 next to RECM:** Of course, you can always go back and change these numbers anytime by repeating this procedure.

Using the keyboard to transpose sequences:

Sequences can be transposed from the keyboard in the following manner:

1. **Press PROGRAM on the Display-Select keypad to get back to the combiprogram display.**

2. **Move the cursor all the way to the right so that the Main Display appears.** A quick way to do this is to press DATAT. and then use the right arrow key to move the cursor over one more time so the Main Display appears.

3. **Move the cursor further to the right until it is under the 0 next to SPLIT:**

4. **Enter a number between 00 and 61, corresponding to the number of semi-tones you want to have available for transposing the sequence.** The notes to the left of the split point will not sound, while the right side of the keyboard will still sound normally, unless you've used all the voices up by using all eight channels of the sequencer, in which case, the keyboard not be able to sound any notes until you turn the sequencer off (by entering 99 next to SEQ:) or call up a sequence that doesn't use all the voices. (Demo sequence number 3 is set up to demonstrate transpositions and improvisation.)

   The notes to the left of the split can be used to transpose the sequencer while it's playing. The bottom *C* is equal to no transposition. Every note above it transposes the sequence by its intervalic relation to the lowest *C* on the keyboard.

Storing the keyboard split used for transposition:

If you want to store the keyboard split for transposition along with the sequence:

1. **Enter a 9 next to RECM:** This stores the keyboard split, tempo, and number of loops along with the sequence.

MULTI-PARAMETER MIXING (UPDATE FUNCTIONS).

After you've recorded a sequence, the individual sequence channels can be modified (updated) in real time during playback using the eight analog pots that normally affect the ADSRs. These updates can affect a number of parameters, including pitch, loudness, filter cutoff, the waveforms, and the amount of control over the VCF cutoff that the first ADSR has.

The updates can be stored as part of the sequence, which means that you can get automated filter sweeps, cresendos and decresendos, waveform sweeps, and pitch changes. However, only one parameter per channel can be updated and stored as part of the sequence. This parameter is called the Main Update. A Second Update can be performed manually while the sequence is playing back.

Here's the way multi-parameter mixing works:

1. **Call up a sequence that you've already recorded by entering its number next to SEQ:** Remember that channels with data recorded in them will have a 0 next to the channel number, empty channels will have a 3 next to them.

2. **Enter the number that corresponds to the desired parameter next to the channel you want to modify.** When you actually record an update any number of channels can be modified at the same time. Here's a list (which is duplicated just above the display window) of the parameters and their corresponding code numbers:

   4= negative pitch.
   5= positive pitch.
   6= loudness.
   7= filter cutoff.
   8= waveform.
   9= filter envelope attenuation.

3. **Press the PANEL button on the Display-Select keypad if the second panel light isn't lit.**

4. **Press RUN/STOP on the Display-Select keypad and enter a 1 to start the sequence.**

5. **Turn the pot that corresponds to the channel you want to update.** Remember that it is the eight ADSR controls that double as multi-parameter mixing controls when the second panel function is on. Each pot is labelled as to what channel it affects.

Here's a more specific example updating loudness to try--updating loudness- for the first time you use the multi-parameter mixing function:

1. **Press PANEL on the Display-Select keypad if the second panel function isn't already on.**

2. **With an already recorded sequence number entered next to SEQ:, enter a 6 (for loudness) next to all of the channels.** You can only enter the codes for updating when the sequencer isn't running.

3. **Start the sequence by entering a 1 next to RUN:** You should hear nothing, even though the sequence has been started, because the PPG is waiting to see some changes made in the loudness levels.

4. **Experiment with turning the pots for the ADSR envelope generators.** You should be able to control the volume of each channel using these eight controls (as long as the second panel function is turned on, that is).

Try out the other update parameters. Experiment with them together and see what effects you can acheive. Here's a run-down of what these parameters do:

Code 4/5= update pitch. In order to hear this function, select a recorded channel to alter, reducing the volume of all the others by using code 6 as described above. Now enter either a 4 (for lowering pitch) or a 5 (for raising it) next to the appropriate channel. After you start the sequence, turn the pot that corresponds to the channel you're working with and you'll hear the pitch change.

Code 6= update loudness. Described above.

Code 7= **update the filter's cutoff frequency.** This code causes the pots to react such that their 12 o'clock setting is equal to zero. Mvoing them to the left causes negative change in the filter's cutoff frequency. Moving them to the right of 12 o'clock causes positive change in the filter cutoff.

Code 8= **update the waves.** With this function. a value of 64 can be added to that set by the Waves control on the Analog Panel. This can produce some pretty wild and unpredictable effects that can be a lot of fun. Depending on what the original wave setting was, it is possible to drive the waves into areas where there is no waveform, an effect that produces high-pitched digital noise.

Code 9= **update the fitler attenuation of the filter envelope.** Using this code, you can adjust the amount of effect ADSR-envelope 1 has on the filter's cutoff frequency.

Storing the Update functions as part of a sequence:

As mentioned, it's possible to "automate" the update function in that you can record your real-time update changes as part of a sequence.

1. **Enter the desired update code for one or more channels.** When recording updates as part of a sequence, only any number of channels can be updated at a time, but we'd recommend limiting it to two at a time, since you only have two hands.

2. **Enter a 2 next to RECM:** This tells the sequencer to record whatever movements you make with the selected channel's ADSR/CH pot.

3. **Start the sequence playing by entering a 1 next to RUN:** Note: there will be no count down before the sequence starts.

4. **"Play" the appropriate channel pot to effect whatever update you want to make.** When the sequence is complete, the 2 next to RECM: will disappear and whatever update you made will be heard the next time you play the sequence back. If loops are entered, the update will play every time the sequence repeats.

If you should want to practice the update before recording it, skip entering the 2 next to RECM: in the steps outlined above. Instead, go ahead and start the sequence. You'll be able to practice your update. It can be repeated as often as you'd like. When you think you're ready to record it, go ahead and enter the 2 next to RECM:, start the sequence, and perform the update.

Note that if you want to start a sequence from silence, it's possible to move the pots to zero, or whatever starting point you'd like, before starting the sequence. The starting position of the pots will be recorded when the update is stored.

Performing manual updates over recorded updates:

It is possible to add a second update parameter to those you have stored in the sequence memory. This second update cannot be stored, but rather has to be played manually. However, the parameter itself can be stored with the sequence so that you don't have to keep entering it next to the appropriate channel everytime you call up the sequence. Demo sequences 1, 2, and 4 are examples of this. Here's how you do it:

1. **Enter the second update parameter code next to the appropriate channel.** This parameter cannot be the same as the parameter that's stored as the main update in the sequence memory.

2. **Enter a 9 next to RECM:** This stores the secondary update as part of the sequence, so the next time you call up the sequence, the channels will be set to whatever update code you stored.

Turning the sequencer off:

When you want to stop using the sequencer and get back to using the PPG as a polyphonic synthesizer:

1. **Enter 99 next to SEQ:** This turns the sequencer off.

SYNCING THE SEQUENCER TO EXTERNAL DEVICES.

You will find, on the back panel, two mini-switch blocks and a 5-pin socket labelled RHYTHM. These are used to synchronize the PPG's sequencer to external devices such as drum machines, other sequencers, and tape-sync tones.

The switch blocks consist of two sets of mini-switches. The first has eight switches (numbered 1-8) and the second has four switches (numbered 1-4). These are used to set the rate of the Wave's internal clock in pulses per click (PPC).

The 5-pin connector is used to get a number of signals out and in to the PPG. A DIN-to-minijack adapter is supplied with your PPG, but if you've lost it, you're probably wondering how you're going to connect the 1/4" jack on your drum machine's clock in or out to the 5-pin DIN connector. This answer is to make or buy a cable that's suited to the job. Some cassette recorders use 5-pin DIN connectors to get to their run/stop function remotely, so many electronics stores carry the type of cable you need for getting to the sync functions (and the cassette interface for that matter). It features a 5-pin DIN plug at one end and five mini plugs at the other.

If you can't find this type of connector in a store and need to make your own, the pins are configured (left to right, pin 1-5):

Pin 1= start/stop (output of the PPG's run function).
Pin 2= ground.
Pin 3= internal clock output.
Pin 4= not used.
Pin 5= external clock in.

After you've gotten the proper connector together and you want to synchronize the PPG with external devices, the following charts will help you figure out how to connect everything.

External device as slave, PPG as master clock:

1. **Connect pin 3 to the drum machine's clock input.**

2. **Connect pin 1 to the start/stop footswitch input on the drum machine if there is on.**

3. Set the clock rate on the PPG using the switch blocks (see below) to whatever rate the external device wants to see (refer to its owner's manual. Make sure pins 1 and 2 are down on the 4-switch block (this set the clock to internal control).

External device as master, PPG as slave:

1. Connect pin 5 to the external device's clock output. Pin 5 needs to see a 1-Volt rising-edge pulse.

2. Set the clock rate of the PPG to the appropriate value, depending on what the external device is sending (refer to its owner's manual. Make sure that either switches 1 and 4 (192 clock pulses) or switches 3 and 4 (64 clock pulses) are down on 4-switch block (sets the clock for external control).

To record a sync-to-tape tone from the PPG:

1. Connect the clock out (pin 3) to an input of your recording console.

2. Set the input level on the board to +2 VU.

3. Set the switches on the back of the PPG as follows:

   8-switch block: 1 and 3 down.
   4-switch block: 1 and 2 down.

   This will produce a 192-PPC tone.

4. Put the tape recorder into record mode and run tape.

5. Enter a 1 next to RUN in the sequencer display to run the sequencer at the desired tempo.

6. Stop tape when finished.

To sync from tape:

1. **Connect the output of the recorder channel with the sync tone recorded on it to the console or other device which will raise the output signal to at least +5 VU. If you have an oscilloscope, the signal must be at least 2.5 Volts peak-to-peak.**

2. **Connect the return from the tape recorder, with signal boosted as indicated, to the clock in (pin 5) on the PPG.**

3. **Set the switches on the back panel as follows;**

   4-switch block: Switch 1 and 4 down.

   8-switch block: When syncing from tape, the pulses sent from the 8-switch block can be used to drive other devices that are connected to the PPG's clock out via pin 3. To do this, either switch 1 or switch 2 (but not both!) should be down. The other switch (and only one other can be down) used will depend on how many pulses per quarter note the external device needs to see at its clock input. For example, the combination of switches 1 and 4 can be used to send a 96-pulse clock to an Oberheim drum machine.

4. **Enter a 1 next to RUN in the sequencer display and start the tape recorder.** To get the most accurate results, make sure you start the sequencer from the beginning of the sync tone on tape.

The Switch Blocks.

The 8-switch block determines the number of pulses per quater note put out by the internal clock. Switches 1 and 2 determine the basic frequency of the master clock, therefore only one of these two switch my be on simultaneously. Switches 3-8 divide the master clock rate by fixed amounts. Like switches 1 and 2, only one of these switches can be on at one time.

Here's a breakdown of the 8-switch block functions:

Switch 1= sets master clock rate at 768 pulses per quarter note.

Switch 2= sets master clock rate at 256 pulses per quarter note. Only one of these switches can be on at a time.

Switch 3= divides the master clock rate by 1/4 (192 PPQ with switch 1 on; 64 PPQ with switch 2 on).
Switch 4= divides the master clock rate by 1/8 (96 PPQ with switch 1 on; 32 PPQ with switch 2 on).
Switch 5= divides the master clock rate by 1/16 (48 PPQ with switch 1 on; 16 PPQ with switch 2 on).
Switch 6= divides the master clock rate by 1/32 (24 PPQ with switch 1 on; 8 PPQ with switch 2 on).
Switch 7= divides the master clock rate by 1/64 (12 PPQ with switch 1 on; 4 PPQ with switch 2 on).
Switch 8= divides the master clock rate by 1/128 (6 PPQ with switch 1 on; 2 PPQ with switch 2 on).
Of switches 3-8, only one can be on at a time.

The 4-switch block works such that different combinations of switch settings determines whether the PPG will act as a master or a slave. Here's a breakdown of the functions:

1 & 2 down= PPG is the master.
1 & 4 down= PPG is the slave and reads a 192-pulse clock.
3 & 4 down= PPG is the slave and reads a 64-pulse clock.

USING AN EXTERNAL SEQUENCER.

If you are like most normal humans, chances are you'll be using some kind of external MIDI sequencer, if you're going to use an external sequencer with the PPG at all. To do this, simply connect the sequencer's MIDI out with the PPG's MIDI in and select what MIDI channel you want to PPG to receive on (the PPG is normally in Poly mode [omni off/poly on], by entering that channel's number next to MIDI: in the Main Display. Refer to the section on the PPG's MIDI implementation for more details on what the 2.3 will respond to under MIDI control.

Should the PPG lag behind other instruments while under MIDI control, there isn't much you can do in live performance. However, in recording you can sync to a click track that has been pre-delayed by 20 or 30 milliseconds. You'll a sync box like a Garfield Dr. Click to drive the MIDI sequencer from a click track. All you need do then is record each instrument separately, moving the clock forward or backward in time (with a DDL) relative to the beat, lining the instruments up relative to the actual beat. Use whatever instrument in the chain has the slowest response time as the reference.

If you want to load the MIDI sequencer from the PPG's keyboard, connect the PPG's MIDI out to the sequencer's MIDI in. The PPG transmits on MIDI channels 1-16 (see page 75 for details).

Using an Analog Sequencer.

If you have a pre-MIDI sequencer that uses control voltage and gate/trigger outputs (such as the Oberheim DSX or even older-style Moog or ARP analog sequencers) you can control up the four of the PPG's voices by using the CV and TRIG inputs on the rear panel. Here's the procedure:

1. **Put the PPG into 2.2 mode by entering a 2 next to PPG 2. in the Main Display.**

2. **Connect the sequencer's CV out to the PPG's CV in.**

3. **Connect the sequencer's trigger out to the PPG's TRIG in.**

4. **Turn the external sequencer on first, then power up the PPG.** The external sequencer should produce a 0-volt gate in order for the PPG to respond properly.

5. **Select the Sequence Display by pressing SEQUENCE on the Display-Select keypad.**

6. **Enter 98 next to SEQM:** A keyboard split will automatically be entered at 24 and all the CH's will be set to 0. The lower half of the keyboard can be used to transpose the sequence at any time, and the key split can be changed to any value desired. The upper half of the keyboard will remain free to play along with the sequence.

7. **Get back to the Main Display and use any of keyboard modes 4, 5, 6, 7, or 8.** The sequencer can only be used to control the voices of 2.2 mode's Group B, which are voices 2, 4, 6, and 8.

8. **Back in the Sequencer Display, enter a 3 next to CH's 2, 4, 6, and/or 8.** This selects which of Group B's oscillators are to be controlled by the external sequencer. The upper half of the keyboard can be used to play along with the sequence.

9. **Start the external sequencer.** Note that the update functions on the PPG's sequencer cannot be used while the analog sequencer is in operation.

THE ARPEGGIATOR.

First Enter 10 or 20 for SEQ: To initialize it.

The Arpeggiator is accessed through the Sequence Display. To get the arpeggiator to function, enter one of the following codes next to SEQM:

11= up (arpeggiates notes from lowest to highest).
12= down (arpeggiates notes from highest to lowest).
13= up/down (arpeggiates from lowest to highest and then back).
14, 24= random.
15, 25= moving (if you play a chord, it will run through it's inversions--*C, E, G* becomes *E, G, C* then *G, C, E* and so on).
21= downward arpeggiation with repeats (the number entered next to LOOPS: determines the number of repeats before the arpeggiated pattern repeats itself).

After you enter one of the above codes, you will see the number next to LOOPS jump to 99 and the channel numbers go to 0. What you won't see is that the key split in the Main Display goes to 24, leaving the upper portion of the keyboard for playing along with the arpeggio. In order to hear any arpeggiation, you have to tell the arpeggiator to start by entering a 1 next to RUN:

To start the arpeggiator, enter a 1 next to RUN.

To stop the arpeggiator, enter a 0 next to RUN.

To start the arpeggiator from the exact point it was stopped at, enter a 2 next to RUN.

To step through the arpeggiation one note at a time, enter a 3 next to RUN. To get the arpeggiation to play, hold the 3 down. To stop it, let up on the 3.

The Update codes for multi-parameter mixing can also be used for the arpeggio function. Enter the same codes you did when using multi-parameter mixing with the sequencer next to the channel numbers. Note that on some software revisions, you may have to update each channel's volume before you hear any arpeggiation at all.

The tempo of arpeggiation is determined by the LFO RATE/SEQU. pot on the Analog Panel when the panel is in second panel mode.

Enter 99 next to SEQM: to turn the arpeggiator off.

Aside from controlling the PPG's internal voices, the arpeggiator is sent out over MIDI, and can therefore be used to control external synthesizers. All operation is identical to those described above. Just connect the PPG's MIDI out to the external device's MIDI in, turn MIDI on in the Main Display by entering a number between 1 and 16 next to MIDI to select the MIDI channel you'd like the PPG to send information out on, and you're ready to use the PPG's keyboard, arpeggiator, or sequencer to control the instrument it's MIDIed to.

Here's the entire procedure for using the arpeggiator:

1. **Enter the desired arpeggiation mode number (11, 12, 13, 14, 15, 21, 22, 23, 24, or 25) next to SEQ:** This turns the arpeggiation function on.

2. **Enter a number next to LOOPS.** This number will have a different effect depending on the arpeggiation mode selected. In modes 11-15 the number determines the number of octaves that the arpeggiation will occur over. In modes 21-25 it determines the meter of the arpeggiation.

3. **Play a chord on the keyboard.**

4. **Enter a 1 next to RUN.** This starts the arpeggiation. You can change the number next to loops at any time while the arpeggiator is running. In fact, this is a good way to see what effect different numbers have on the arpeggiation pattern. Remember, some software revisions require that you perform a multi-parameter mixing function--updating the volume of each voice--in order for you to hear the arpeggiation. To do this, enter 6's next to the channels, and use the ADSR controls in second panel mode to turn the volume of the voices up.

5. **To enter new notes for arpeggiation, lift up on the notes being sounded and slowly depress the new notes.** You don't have to continue to hold notes down after they're played for the arpeggiator to act on them, since the arpeggiator automatically latches whatever notes you play.

What sound gets assigned to the arpeggiated voices. The sound in combiprogram bank 0 will appear on voice channels 1, 3, 5, and 7. The sound in bank 1 will appear on voice channels 2, 4, 6, and 8. In 2.2 mode, the Group A soundprogram will be assigned to voice channels 1, 3, 5, and 7, while the Group B sound will be assigned to voice channels 2, 4, 6, and 8.

Section 4
MIDI

MIDI

The PPG Wave 2.3 features the Musical Instrument Digital Interface (MIDI), which allows it to communicate with other MIDI-equipped devices without the need for expensive interfacing hardware. All that's needed to connect two MIDIed instruments together are a couple of 5-pin DIN MIDI cables.

To connect the PPG to another device with MIDI use the following procedures:

PPG as slave:

1. **Connect the MIDI out of the instrument to be used as the master to the PPG's MIDI in.**

PPG as master:

1. **Connect the MIDI out of the PPG to the MIDI in of the instrument or device that will act as the slave.**

If multiple instruments are involved:

1. **Connect the MIDI thru of the slave to the MIDI in of the next slave in the chain.** If more than two or three instruments are to be connected using MIDI, we strongly recommend using a MIDI thru box, which takes one MIDI in and sends it to multiple MIDI outs. This eliminates time delays caused by putting too many instruments in series.

To turn the PPG's MIDI function on:

1. **Enter a number between 1 and 18 next to MIDI: in the Main Display.** Numbers between 1 and 16 will determine which one of the 16 MIDI channels the PPG will send and receive MIDI information on. Entering 17 or 18 puts the PPG into MIDI mono mode (omni off/mono), which causes each of the eight PPG voices to be assigned to its own MIDI channel, allowing the PPG to be controlled multi-timbrally by external MIDI sequencers.

   In MIDI mono mode, not only does each voice get assigned to a single MIDI channel, but each voice gets assigned to the

soundprogram in the combiprogram bank that corresponds to the voice number minus one. For example, after you've entered 17 next to MIDI, voice one is assigned to combiprogram bank 0, which is also permanently assigned to MIDI channel 1 (as long as you're in MIDI mono mode). Voice two is assigned to combiprogram bank 1, which is assigned to MIDI channel 2. Voice three gets bank 2 (channel 3), and so on. Use MIDI: 18 when you send data to the PPG on MIDI channels 9-16 when it's in mono mode. This will assign data on MIDI channel 9 to voice 1 (bank 0). Data on MIDI channel 10 will go to voice 2 (bank 1), and so on.

Using mono mode with the sequencer assigns each sequencer channel to the corresponding MIDI channel (sequencer channel 1 is assigned to MIDI channel 1, sequencer channel 2 gets MIDI channel 2, and so on). Sequencer data is both sent and received over MIDI.

To turn the MIDI function off:

1. Enter a 0 next to MIDI: in the Main Display.

What the PPG sends over MIDI:

Pitch-bend. The pitch-bend wheel can be used to control an external MIDI synthesizer *if* that instrument is capable of receiving pitch-bend information. Note also, that the range of the pitch bend will be determined not by the PPG's pitch-bend range function in the Digital Display but by the pitch-bend range control on the external instrument, if such a control exists.

Modulation. Like the pitch-bend wheel, the modulation wheel can be used to control an external MIDI synthesizer if that instrument is capable of receiving that data over MIDI. Of course, in order to hear the function, the external instrument must be set to respond to a modulation wheel.

Sequencer notes. In MIDI mono mode (MIDI:17 or 18 entered in the Main Display), each channel of the sequencer will send note data over its corresponding MIDI channel to control external MIDI instruments . The sequencer channels correspond to MIDI channels such that sequencer channel 1 is assigned to MIDI channel 1,

sequencer channel 2 gets MIDI channel 2, and so on. In poly mode, all the sequencer channels are assigned to the selected MIDI channel.

Arpeggiator notes. With the arpeggiator function on, notes played on the PPG's keyboard are sent out on the assigned MIDI channel and will arpeggiate the slave synthesizer.

Note data. The PPG will send note data from its keyboard over the MIDI channel the instrument is assigned to by the number next to MIDI: in the main display.

Program changes. New soundprogram numbers entered from the numeric keyboard will be sent out as program change commands over MIDI.

What the PPG receives over MIDI:

Pitch-bend. Incoming pitch-bend data will be received by the PPG, but you'll only hear it if the pitch-bend function is turned on in the Digital Display.

Modulation wheel (MIDI controller #1). Incoming modulation wheel data will be received by the PPG, but again, if the instrument isn't set to respond to it in the Digital Display, you won't hear any effect. In Mono mode, modulation is restricted to the voice corresponding to the MIDI channel it comes in over.

After-touch. The PPG will respond to after-touch, but it has to be turned on in the Digital Display.

Velocity. While the PPG's keyboard isn't velocity-sensitive the PPG will respond to incoming MIDI velocity.

Master volume (controller #7). If you're using a MIDI master keyboard controller to play the PPG remotely, you will find this function very useful. It allows you to adjust the volume of the PPG remotely over MIDI.

Sustain switch (controller #64, 66, 67). When a sustain pedal is pressed on a remote MIDI instrument, it will cause the PPG to react as if its own sustain pedal had been pressed.

All notes off command (controller #123, 125, 126, 127). This command comes in handy when you get notes locking on because the MIDI data flow was interrupted for whatever reason. It causes all the notes to turn off.

Program changes. When in Poly mode, in order for the PPG to be able to receive program changes from external MIDI controllers, the cursor must be positioned under the Bank Basis number in the combiprogram display. Program changes will select new soundprograms in the combiprogram bank selected by the Bank Basis number. The program number shown in all the PPG's displays will change when program changes are received over MIDI. In Mono mode, program changes will be made in the combiprogram bank defined by the selected MIDI channel.

Sequencer notes. In MIDI mono mode (MIDI:17 or 18 entered in the Main Display), each channel of the sequencer will receive note data from an external MIDI controller over its corresponding MIDI channel. The sequencer channels correspond to MIDI channels such that sequencer channel 1 is assigned to MIDI channel 1, sequencer channel 2 gets MIDI channel 2, and so on.

Note data. Note data is received by the PPG in either MIDI poly mode (omni off, poly mode). This means that when the PPG is in this mode, it will only respond to MIDI data that's on the channel selected next to MIDI: in the Main Display. Even though the PPG itself only has a 5-octave keyboard, it will respond over the entire range of an external 88-note MIDI controller.

In addition, certain Wave 2.3 functions can be remotely addressed by various MIDI controllers. These include:

Waves (MIDI controller #2).
Filter cutoff frequency (MIDI controller #4).
Loudness (controller #7).
Release time (controller #8).
Poly mode (controller #127).
Mono mode (controller #125).

PPG's MIDI ID number is $29.

Section 5

the cassette interface

THE CASSETTE INTERFACE.

All your sounds and sequences can be stored externally on audio cassette tape using the cassette interface.

On the back panel of the 2.3 you will see a 5-pin socket labelled CASSETTE. This socket requires you to use a DIN-plug-to-minijack adapter, which you can find in many electronics stores. You may have to experiment a bit to figure out which jack carries the audio data (it on pin number ?).

To access the Cassette function:

1. **Call up the Main Display and move the cursor next to CASS:**

2. **Enter a number between 0 and 4, depending on the data you want to record to tape or load from tape.** The recorder should be set to a record level of 0dB. Do not use any kind of noise reduction, since it will distort the digital signal and bung up the data. Just after you enter the number next to CASS: a tone will be sent out from the PPG. Use this to set your level. After the tone will come a series of high-pitched noise. This is the digital information that is used to tell the PPG's internal computer what your presets and/or sequences were. This is the signal you want to record. If you don't have enough time to set the level before this signal starts, don't worry. Just repeat the procedure after setting the level. It takes about two minutes to complete a data dumb to or from cassette. When the process is complete, a 0 will appear next to CASS:

   Only complete sets of programs or sequences can be transferred to tape. It isn't possible to store single soundprograms.

The cassette codes are as follows:

0= off.
1= used for loading soundprogram and/or sequencer information from tape into the PPG.
2= sends all soundprograms from memory onto tape.
3= sends all sequencer data to tape.

4= data recorded onto tape is checked against the memory in the PPG to verify if a good recording has been made. If a mistake is present a 9 will appear next to CASS:

To verify data loaded onto a cassette:

1. **After loading data onto a cassette, rewind the tape to the beginning of the data.**

2. **Use the cassette's internal speaker (or headphones if necessary) to listen for the tone before the data begins.**

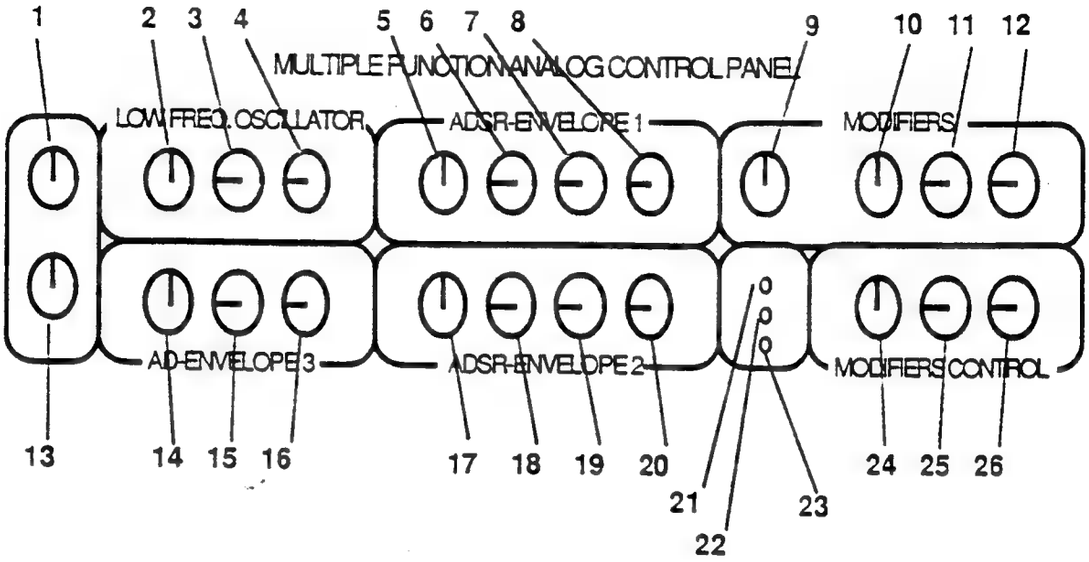
3. **As soon as you hear the tone, enter a 4 next to CASS: and let the data tape play through the data.** A 0 will appear next to CASS: if no errors are present. If an error occurs, a 9 will appear next to CASS: If this happens, you must repeat the data transfer to tape, checking to make sure the cable is properly connected and the level is set properly.

Note: We recommend saving the sequence buffer to tape whenever you finish working with a sequence. If you have a Waveterm, or are planning to add one to your Wave 2.3, you should be aware that sequences can be saved on the Waveterm's floppy disks. However, sequence 00 is the only one you'll be able to store on the floppy.

Section 6

quick reference guides

QUICK REFERENCE GUIDE: MULTIPLE FUNCTION ANALOG PANEL



1. **BASIS.** Adjusts width of stereo image.

2. **DELAY.** Sets initial delay between when a key is pressed and when LFO modulation begins.

3. **WAVESHAPE.** Determines LFO waveform.

4. **RATE/SEQUN.** Adjusts LFO rate. In Second Panel mode, this pot determines the sequencer playback speed.

5. **A1/CH1.** Determines attack time of ADSR-envelope 1. In Second Panel mode, this pot controls Channel 1 of the sequencer for multi-parameter mixing.

6. **D1/CH3.** Determines decay time of ADSR-envelope 1. In Second Panel mode, it controls Channel 3 of the sequencer for multi-parameter mixing.

7. **S1/CH5.** Determines the sustain level of ADSR-envelope 1. In Second Panel mode, it controls Channel 5 of the sequencer for multi-parameter mixing.

8. **R1/CH7.** Determines the release time of ADSR-envelope 1. In Second Panel mode, it controls Channel 7 of the sequencer for multi-parameter mixing.

9. **VCF-CUTOFF.** 24dB-per-octave lowpass voltage-controlled filter cutoff frequency control.

10. **VCF-EMPHASIS.** Controls the amount of emphasis (resonance, Q, regeneration) given to the frequencies immediately flanking the filter cutoff frequency.

11. **WAVES-OSC.** Sets the Basic Waveform Number of the Main Oscillators.

12. **WAVES-SUB.** Sets the Basic Waveform Number of the Suboscillators.

13. **VOLUME.** Sets the master volume.

14. **ATTACK 3.** Adjusts the attack time of AD-envelope 3, which can be routed (via the Tuning Display) to modulate the pitch of the Main and/or Suboscillators, or the waveform of the suboscillators (via the Digital Display).

15. **DECAY 3.** Adjusts the decay time of AD-envelope 3 (see 14 for routing details).

16. **ENV.3 ATT.** Attenuates the output of AD-envelope 3. Note that when envelope 3 is used to control pitch (via the Tuning Display), a setting of 5 equals no modulation. Higher settings equal positive modulation; lower settings equal negative modulation. When envelope 3 modulates the waveform of the suboscillators, the attenuator acts normally; *i.e.* 0 is off, 10 is full-on.

17. **A2/CH2.** Determines the attack time of ADSR-envelope 1. In Second Panel mode, it controls Channel 2 of the Sequencer for multi-parameter mixing.

18. **D2/CH4.** Determines the decay time of ADSR-envelope 2. In Second Panel mode, it controls Channel 4 of the Sequencer for multi-parameter mixing.

19. **S2/CH6.** Determines the sustain level of ADSR-envelope 2. In Second Panel mode, it controls Channel 6 of the Sequencer for multi-parameter mixing.

20. **R2/CH8.** Determines the release time of ADSR-envelope 2. In Second Panel mode, it controls Channel 8 of the Sequencer for multi-parameter mixing.

21. **GROUP A LED.** In 2.3 mode: When lit indicates that the Group A keyboard arrangement is engaged.

    In 2.2 mode: When lit indicates the Group A sound is loaded into the working memory and is available for modification. If Keyboard mode 0 is selected and the LED is lit, the Group A sound will be sounded from the keyboard.

22. **GROUP B LED.** In 2.3 mode: When lit indicates that the Group A keyboard arrangement is engaged.

    In 2.2 mode: When lit indicates the Group B sound is loaded into the working memory and is available for modification. If Keyboard mode 0 is selected and the LED is lit, the Group B sound will be sounded from the keyboard.

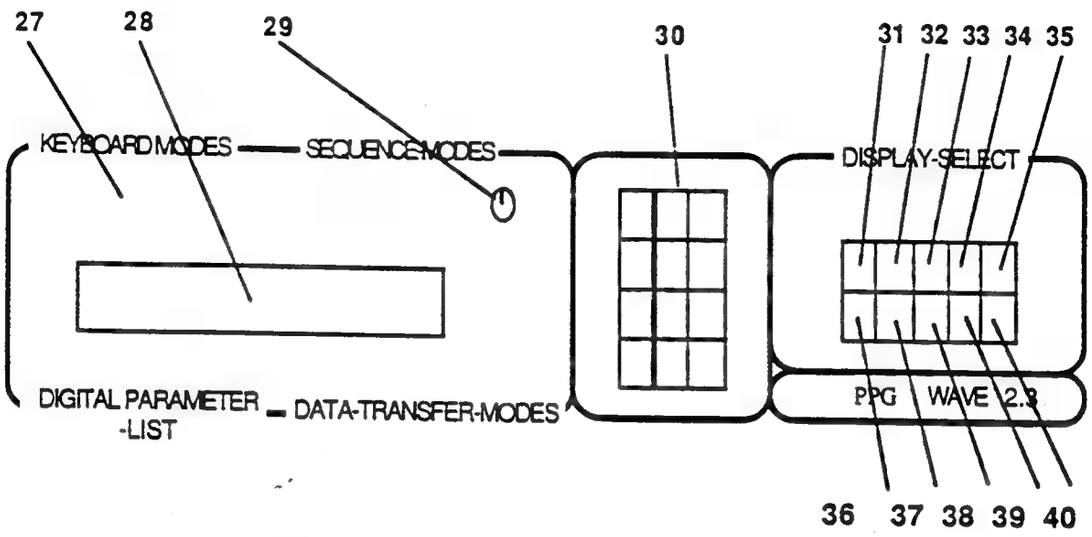
23. **SECOND PANEL LED.** When lit indicates that controls 4, 5, 6, 7, 8, 17, 18, 19, and 20 affect the sequencer playback speed, and affect the eight channels in multi-parameter mixing mode.

24. **ENVELOPE 1->VCF.** Attenuates the amount of control voltage from ADSR-envelope 1 as it affects the filter's cutoff frequency (brightness).

25. **ENVELOPE 2->LOUDN.** Attenuates the amount of control voltage from ADSR-envelope 2 as it affects the VCA (loudness).

26. **ENVELOPE 1->WAVES.** Attenuates the amount of control voltage from ADSR-envelope 1 as it affects the waveform number of the main oscillators (to create waveform cascades).

QUICK REFERENCE GUIDE: MULTIPLE FUNCTION DIGITAL CONTROL PANEL



27. OPERATION MODE LISTS. Lists of Keyboard modes, Sequencer/Arpeggiator modes, controller sources and destinations, and Data-Transfer modes.

28. DISPLAY WINDOW. An 80-character LCD used to communicate numerous functions to the user, including the Analog parameter display, Digital parameter display, 2.3 and 2.2 Main Displays, Combiprogram display, Tuning display, and Sequencer display.

29. BRIGHTNESS CONTROL. A rotary pot that adjusts the brightness of the display. It is used to make the display readable at different angles and under different lights.

30. NUMERIC KEYPAD. Used to enter numeric values. Arrow keys more the cursor to the left and right.

31. PROGRAM. In 2.3 mode: Returns the cursor to the Combiprogram number in the Combiprogram display no matter where the cursor is prior to pressing the Program button.

In 2.2 mode: Returns the cursor to the Program number in the Main Display regardless of where the cursor is prior to presing the Program button.

32. DIGITAL. Calls up the Digital parameter display in the display window.

33. TUNING. Calls up the Tuning parameter display in the display window.

34. ANALOG. Calls up the Analog parameter display in the display window.

35. SEQUENCER. Calls up the Sequencer display in the display window.

36. GROUP. In 2.3 mode: Selects between Group A or Group B Combiprogram keyboard arrangements.

In 2.2 mode: Selects which soundprogram Group (A or B) is assigned to the working memory and available for modification with the Multiple-Function Analog Controls. When in Keyboard mode 0, the Group selected will also be the Group heard.

37. DATAT. In 2.3 mode: Moves the cursor instantly to the Data-Transfer function in the Combiprogram display.

In 2.2 mode: Moves the cursor instantly to the Data-Transfer function in the Main Display.

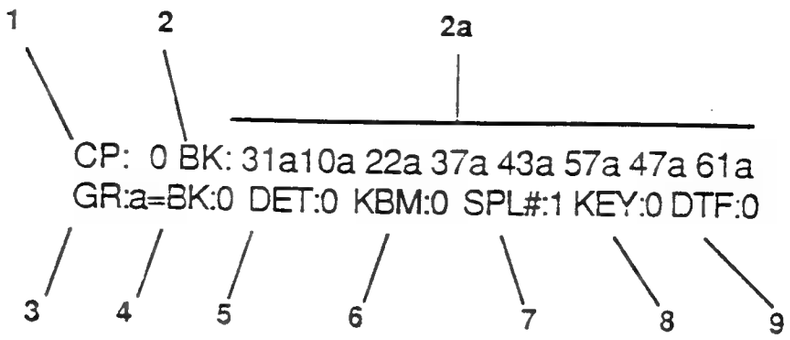
38. KEYB. In 2.3 mode: Moves the cursor instantly to the KBM (Keyboard mode) function in the Combiprogram display.

In 2.2 mode: Moves the cursor instantly to the KEYB (Keyboard mode) function in the Main Display.

39. PANEL. Toggles the Multiple-Function Analog Control Panel between it's normal mode of operation and its Second Panel mode, which assigns a number of controls to adjust various sequencer parameters (see 4, 5, 6, 7, 8, 17, 18, 19, 20).

40. RUN/STOP. Instantly moves the cursor to the RUN function in the sequencer display.

QUICK REFERENCE GUIDE: COMBIPROGRAM DISPLAY*



1. **CP:** Combiprogram number 00-19.

2. **BK:** Bank. There are eight banks, each of which holds one soundprogram, displayed here (**2a**).

2a. Bank numbers 0-7. Each bank holds one soundprogram.

3. **GR:** Group A or B Combiprogram keyboard arrangements (sets of keyboard splits and Bank Basis numbers), selected by the GROUP button on the Display-Select keypad.

4. **=BK:** Bank Basis number. Number 0-7 selects which Combiprogram bank is heard when no keyboard splits are assigned. When keyboard splits are assigned, allocation of sounds to splits is consecutive, and the Bank number entered here will be assigned to the lowest split location.

5. **DET:** Detuning. Turns the suboscillators on and off if they are used in the selected soundprogram. 0= on, 1= off (odd numbers= off, even= on).

6. **KBM:** Keyboard mode. 0= Poly 8 x 1. Eight-voice polyphony, where all eight voices are assigned to produce one sound.

   1= Quad 4 x 2. Layered four-voice polyphony,

   2= Duo 2 x 4. Layered two-voice polyphony.

   3= Mono 1 x 8. All eight voices are assigned to one note.

   4-8 are not implemented in 2.3 mode.

   9= For use with the optional PRK Processor Keyboard.

7. **SPL#:** Keyboard split number 1-7.

8. **KEY:** Split key number (0-61).

9. DTF: Data-Transfer function number (0-7, 9).

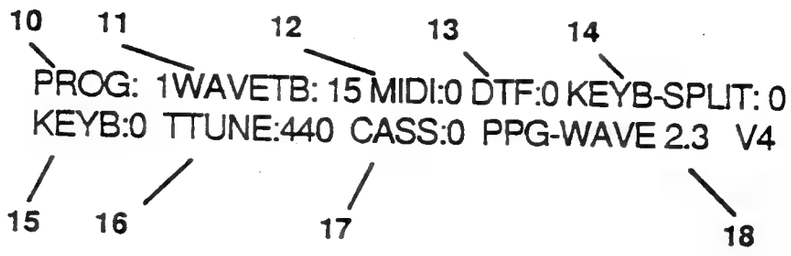
0= Program. Loads currently selected program into the working memory allowing that sound to be played and/or altered by the various controls.

1-7 are used in 2.2 mode.

9= Store. Used to record information into the PPG's mem[illegible].

* Active only in 2.3 mode.

QUICK REFERENCE GUIDE: 2.3 MAIN DISPLAY*



10. PROG: Soundprogram number (00-86). Inactive in 2.3 mode except when you are using MIDI; active in 2.2 mode.

11. WAVETB: Wavetable number (00-31).

12. MIDI: Musical Instrument Digital Interface functions.
0= Turns MIDI off.
1-16= Sets MIDI send and receive channel in poly mode.
17= Puts the instrument into mono mode for sending and receiving sequencer channels in mono mode.

13. DTF: Datatransfer function number (0-7,9).
0= Program. Loads currently selected program into the working memory allowing that sound to be played and/or altered by the various controls.
1-7 are used in 2.2 mode.
9= Store. Used to record information into the PPG's memory.

14. SPLIT: Split point key number (0-61). In 2.3 mode, this number indicates the number of semi-tones the sequencer is being transposed during playback.

15. KEYB: Keyboard mode. 0= Poly 8 x 1. Eight-voice polyphony, where all eight voices are assigned to produce one sound.

1= Quad 4 x 2. Layered four-voice polyphony.

2= Duo 2 x 4. Layered two-voice polyphony.

3= Mono 1 x 8. All eight voices are assigned to one note.

4-8 are not implemented in 2.3 mode.

9= For use with the optional PRK Processor Keyboard.

16. TTUNE: Total tuning. Variable from *A*-400 to *A*-499 Hertz.

17. CASS: Cassette interface.
0= Off.

1= Soundprogram or sequence data can be loaded from data cassette into the PPG.

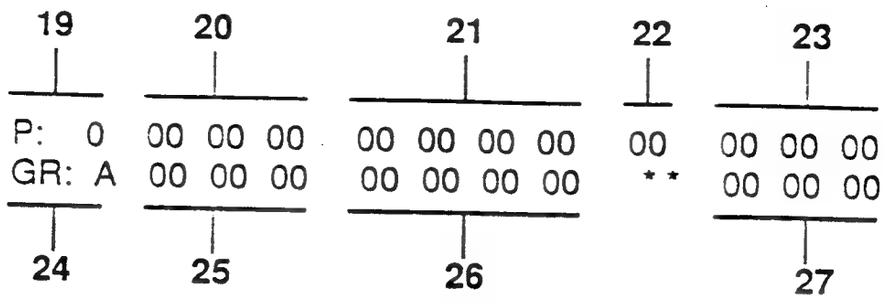
2= Sends all soundprogram data out to a cassette tape recorder.

3= Sends all sequence data out to a cassette tape recorder.

4= Checks data recorded on tape against memory contents. If an error has occured, a '9' will appear next to CASS:

18. V5. Software version. This number indicates the currently loaded software version. Earlier or later version operations may differ from those outlined in this manual.

QUICK REFERENCE GUIDE: ANALOG DISPLAY



19. P: Program number. Inactive in 2.3 mode except when using MIDI, in which case it indicates the currently selected soundprogram, as it does in 2.2 mode.

The number pairs in this display represent numeric values corresponding to the setting of the MULTI-FUNCTION ANALOG CONTROL PANEL. Note that not all controls have the same quantization ranges.

20. LFO. Delay= 16 stages.
Waveshape= 4 stages.
Rate= 32 stages.

21. ADSR-envelope 1. Attack time= 16 stages.
Decay time= 32 stages.
Sustain level= 32 stages.
Release time= 32 stages.

22. VCF cutoff frequency. Quantized in 64 stages.

23. Modifiers. VCF emphasis quantized in 64 stages.
Waves-OSC, main oscillator waveforms, quantized in 64 stages.
Waves-SUB, suboscillator waveforms, quantized in 64 stages.

24. GR: Group A or B. Inactive in 2.3 mode. In 2.2 mode, indicates which Group of soundprograms is currently selected.

25. AD-envelope 3. When used to control the pitch of either the main or suboscillators:
Attack is quantized in 64 stages, 00 being no effect; 63 being greatest effect.

Decay is quantized in 64 stages, 00 being fastest decay of detuning; 63 being slowest decay.

ENV.3 ATT determines amount of positive or negative detuning: 00-31= negative detuning; 32= no detuning; 33-63= positive detuning.

When AD-envelope 3 is used to control the waveform of the suboscillator:

Attack determines the delay between when a key is depressed and when waveform cascading begins. Quantized in 64 stages. 00= no delay; 63= maximum delay.

Decay determines the length of the waveform cascade. Quantized in 64 stages. 00= no effect; 63= maximum cascade.

ENV.3 ATT is used to control the amount of effect. 00= no effect; 63= greatest effect.

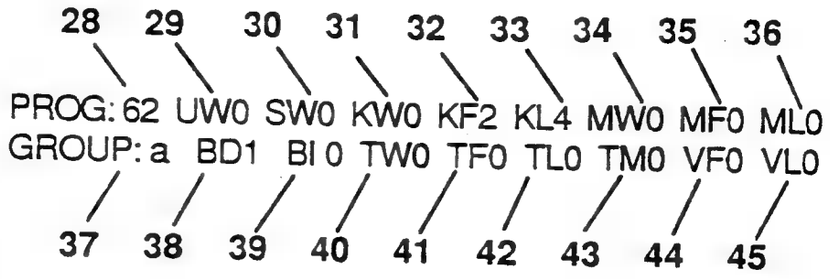
26. **ADSR-envelope 2.** Attack time= 16 stages.
Decay time= 32 stages.
Sustain level= 32 stages.
Release time= 32 stages.

27. **Modifiers Control.** Envelope 1-VCF= ADSR-envelope 1 attenuator as it controls the filter's cutoff frequency. 32 stages.

Envelope 2- LOUDN= ADSR-envelope 2 attenuator as it controls the VCA. 32 stages.

Envelope 1-WAVES= ADSR-envelope 1 attenuator as it controls waveform cascading of the main oscillators.

QUICK REFERENCE GUIDE: DIGITAL DISPLAY



28. PROG: Program number (00-86). Not implemented in 2.3 mode except when MIDI is in use. In 2.2 mode and when MIDI is used, it indicates the currently selected soundprogram number.

29. UW: Upper Waves. Even numbers turn the upper waves on, odd numbers turn them off.

30. SW: Sub Waves. Entering numbers 0-3 here affects the suboscillator.

0= Sets the waveform of the suboscillators to run parallel to that of the main oscillators. The WAVES-SUB pot on the Analog Panel is used to select the actual waveform of the suboscillators. If the WAVES-SUB pot is set to 0, the suboscillators will have the same waveforms as the main oscillators.

1= Determines that the waveform of the suboscillators is only selected by the WAVES-SUB pot. This setting disables any connections that might affect waveform cascades of the suboscillators.

2= Routes AD-envelope 3 to the suboscillator waves. Used for automatic waveform cascades.

3= Turns the suboscillators off.

31. KW: The keyboard controls the wavetable (0-7).

0= no effect.

1-7= Varies amount of effect. A 4 means the waveform selected by the rotary pots will sound on the lowest *C* on the keyboard. 7 produces the greatest effect.

32. KF: The keyboard controls the filter cutoff frequency (0-7).

0= no effect.

1-7= Varies the amount of effect. A 3 produces 100% control--one octave of keyboard changes the cutoff frequency by one octave. 7 equals 200% effect--one octave on the keyboard produces a two-octave change of the filter cutoff frequency.

33. KL: The keyboard controls loudness (0-7).

0= The lowest *C* on the keyboard produces full loudness. Playing progressively higher notes attenuates the loudness. In order to hear this effect, turn the ENVELOPE 2 LOUDN pot full up.

4= no effect.

7= The top *C* on the keyboard produces full loudness.

34. MW: Routes the modulation wheel and LFO to control the waveforms. Even numbers turn the effect off, odd turn it on.

35. MF: Routes the modulation wheel and LFO to control the filter cutoff frequency. Even numbers turn it off, odd turn it on.

36. ML: Routes the modulation wheel and LFO to control the loudness. Even numbers turn the effect off, odd turn it on.

37. Group: Inactive in 2.3 mode. In 2.2 mode, indicates the currently selected Group (a or b).

38. BD: Sets the bender (pitch-bend wheel) destination (0-7).

0= Off.
1= Pitch of the oscillators.
2= Filter cutoff frequency.
3= Waveforms.
4= Pitch of the suboscillators only.
5= Pitch and filter cutoff frequency.
6= Pitch and waveforms.
7= Filter cutoff and waveforms.

39. BI: Bender interval and/or amount of modulation from the bender to the filter cutoff or waveforms (0-3).

0=Major second.
1= Major third.
2= Fifth.
3= Octave.

40. TW: Routes touch sensitivity (after-touch) to the waveforms. Even numbers turn effect off, odd turn it on.

41. TF: Routes after-touch to the filter cutoff frequency. Even numbers turn effect off, odd turn it on.

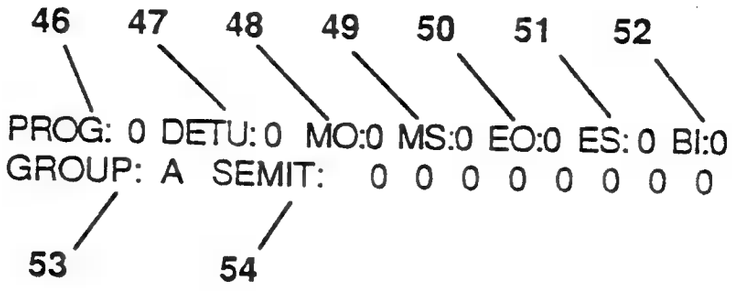
42. TL: Routes after-touch to the VCA to affect loudness. Even numbers turn effect off, odd turn it on.

43. TM: Routes after-touch to control amount modulation from the LFO. Even numbers turn it off, odd turn it on.

44. VF: A remnant of earlier versions of the Wave that used the first note played to set the filter's initial cutoff frequency. Best ignored on the 2.3.

45. VL: Like 42, this is a remnant of an earlier version of the Wave that used the first note played to set the initial volume of the instrument. Best ignored on the 2.3.

QUICK REFERENCE GUIDE: TUNING DISPLAY



46. PROG: Program number (00-86). Inactive in 2.3 mode except when using MIDI. In 2.2 mode and when using MIDI, indicates the currently selected soundprogram.

47. DETUN: Detuning (0-7).

0= no detuning.
1= light detuning.
2= more detuning.
3= noticable detuning.
4= greatest detuning.
5= suboscillators transposed up a fifth.
6= suboscillators transposed up an octave.
7= suboscillators transposed up two octaves.

48. MO: Modulation from the LFO is routed to the main oscillators. Even numbers turn effect off, odd turn it on.

49. MS: Modulation from the LFO is routed to the suboscillators. Even numbers turn effect off, odd turn it on.

50. EO: AD-envelope 3 is routed to control the pitch of the main oscillators. Even numbers turn effect off, odd turn it on.

51. ES: AD-envelope 3 is routed to control the pitch of the suboscillators. Even numbers turn it off, odd numbers turn it on.

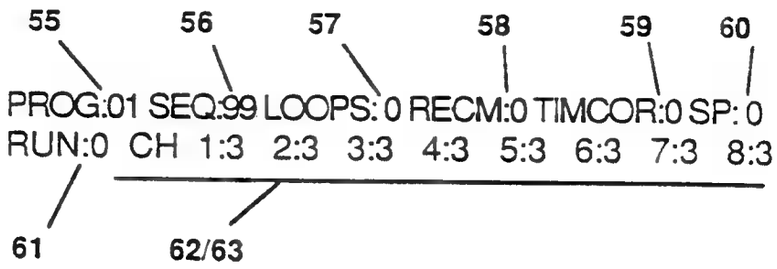
52. BI: Sets the pitch-bend wheel interval (0-5).

0= Major second.
1= Major third.
2= Fifth.
3= Octave.

53. GROUP: Not implemented in 2.3 mode. In 2.2 mode, indicates which soundprogram Group (a or b) is currently selected.

54. SEMIT: Semitone. The eight number pairs here indicate the number of semitones each of the eight voices is transposed by. Numbers can be entered by playing notes on the keyboard, or by enter numbers with the numeric keypad. You should always use the latter method when key splits are set up.

QUICK REFERENCE GUIDE: THE SEQUENCER DISPLAY



55. PROG: Program number. Numbers entered here will enter a new soundprogram in the bank selected as the Basis Bank in the Combiprogram Display. We recommend avoiding program changes while the sequencer is running as it will cause hickups in the rhythm while the computer updates the wavetable information. You can eliminate this effect by using Datatransfer functions 1, 2, or 3 before making program changes.

56. SEQ: Sequence number (00-09). Entering a number between 00 and 09 will call up those sequences. Numbers 11-15, 21-25 are used to set the arpeggiation direction.

11= up
12= down
13= up/down
14, 24= random
15, 25= moving
21= down with repeats

57. LOOPS: Number of loops (00-98, 99= infinite). During record operation numbers entered here determine the length of a sequence in metronome beats (64 maximum). During playback, the number entered here determines the number of times the sequence will repeat or loops. With this number set to 99, the sequence will repeat indefinitely. With arpeggiation function, numbers entered here determine the range of arpeggiation (in octaves) or the number of repeats, and therefore the meter, depending on what arpeggiation mode is chosen.

58. RECM: Record mode (0-4, 8, 9).

0= off.
1= record a new sequence, without first establishing its length. Erases the old sequence, including previously established length. Press RUN/STOP button when you're done entering the sequence to define its length. We recommend using RECM: 4 instead.
2= update memory. Used when recording updates to already recorded sequences with multi-parameter mixing.

3= record polyphonically. A remnant of the 2.2 sequencer, its function is duplicated by RECM: 4, which we suggest you use instead.
4= record length. When recording sequences from scratch, you first enter the length in number of metronome beats next to LOOPS: followed by the time correction and speed, then you enter RECM:4, which records the length of the sequence.
8= erase entire sequencer memory. To do this, 8 must be entered twice. After the first 8, the display will show ?????. . . At this point you can abort the erasure by entering a RECM:0. If you want to complete the erasure, enter the second 8. If a number between 00 and 09 is not entered next to SEQ:, EEEE... (for error) will appear in the display, at which point you enter two more 8's and the sequence memory resets itself.
9= Store. Entering RECM:9 stores the tempo, split point for transposition (set in the main display), number of loops, and secondary update parameters as part of the sequence.

59. TIMCOR: Time correction (0-4, 8). Also known as quantization and autocorrection, this function sets the number of notes you can play per metronome beat.

0= no time correction.
1= quarter notes (one note per beat).
2= eighth notes (two notes per beat).
3= eighth-note triplets (three notes per beat).
4= sixteenth notes (four notes per beat).
8= thirty-second notes (eight notes per beat).

60. SP: Speed. Sets the tempo of the sequencer's play back. With the second panel function on, the LFO RATE/SEQU. control will affect playback speed. When the sequence is stopped, the updated tempo will be displayed next to SP: (0-99).

61. RUN: Running status (0-2).

0= stop.
1= run. Restarts sequence from its beginning.
2= run. Starts sequence from the exact point it was stopped at.

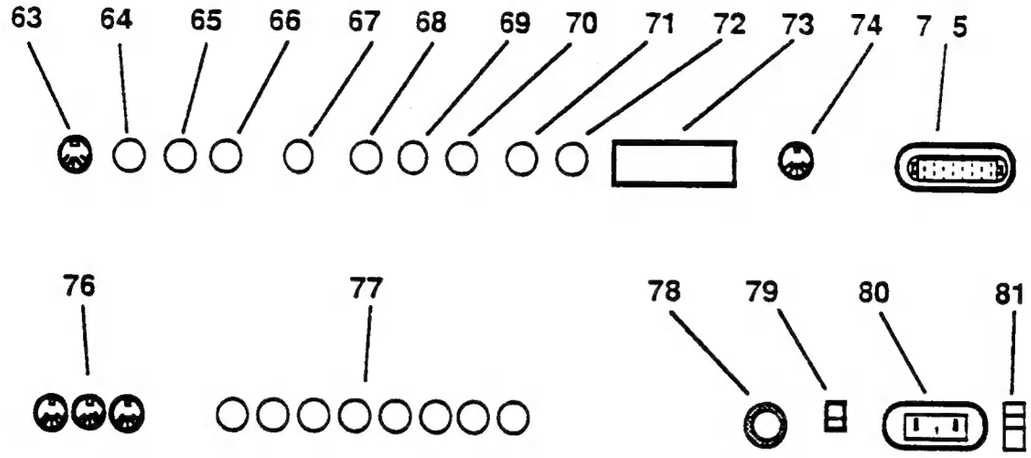
62. CH Channels (1-8). Numbers on the left of the colon (:) indicate the channel numbers. Numbers (0-9) to the left of the colon (:) indicate the running/record status of each individual channel.

0= indicates data in channel.
1= record. When this number is placed next to a channel, the channel is ready to record. If the channel already has data in it, you can add new notes to the existing data.
2= edit. Used when you want to erase single notes or whole channels. With the sequence playing, press and hold the RUN/STOP button while the notes you want to erase are playing. The next time you play back the sequence these notes will not be heard.
3= indicates channel contains no data.
4= update parameter for modifying pitch negatively using the eight ADSR/CH pots in second panel mode.
5= update parameter for modifying pitch positively using the eight ADSR/CH pots in second panel mode.

6= update parameter for loudness using the eight ADSR/CH pots in second panel mode.
7= update parameter for modifying the filter cutoff frequency using the ADSR/CH pots in second panel mode.
8= update parameter for modifying the waves using the ADSR/CH pots in second panel mode.
9= update parameter for modifying the attenuator for the filter's envelope amount using the ADSR/CH pots in second panel mode.

QUICK REFERENCE GUIDE: THE BACK PANEL

(sorry we couldn't fit it all side-by-side)



63. Cassette. Used for connecting a cassette tape recorder for external storage of memory. Require the use of a 5-pin-to-minijack adapter.

64. Phones. Used for listened to the PPG with stereo headphones.

65. CH 1. Channel 1, stereo left, output. With front-panel BASIS control turned fully counter-clockwise, this becomes a mono output.

66. CH 2. Channel 2, stereo right, output. With front-panel BASIS control turned fully counter-clockwise, this becomes a mono output.

67. Sustain. Socket for connecting a sustain pedal.

68. CV In. Control voltage input (1 volt-per octave) for controlling single voices.

69. VCF In. Input for controlling the cutoff frequency of the filters with a voltage pedal.

70. Trig. In. Trigger input. Used when controlling the PPG from an external analog sequencer.

71. Trig. Out. Keyboard trigger output.

72. Program. Socket for connecting a footswitch to increment Combiprogram bank soundprogram numbers. For example, Combiprogram 00 is loaded, the sound in bank 1 is program 19, bank 1 is selected by the Bank Basis number. Using the switch, the program number can be incremented from 19 to 20, 21, 22, and so on up to 86.

73. Clock Rate. Two mini-switch blocks. The first has 8 mini-switches on it. The second has four. These are used to control the timing clock rate of the

sequencer so that it can control drum machines which need to see different clock rates depending on what brand they are.

The 8-switch block determines the number of clocks per qua r no e. Each switch divides the 768-pulse clock. Note that only one swi.ches 1 and 2, and only one of switches 3-8 can be on at one time that only two of the eight switches should ever be on at one time.

On the 8-switch block:

switch 1= mother clock, no division, sets master rate a 3 pulses per click.
switch 2= mother clock, divides clock by 1/3, sets ma r rate at 256 pulses per click.
switch 3= divides the master clock by 1/4 (192 pulses per click with switch 1 on; 64 PPC with switch 2 on).
switch 4= divides the master clock by 1/8(96 PPC with switch 1 on; 32 PPC with switch 2 on).
switch 5= divides the master clock by 1/16 (48 PPC with switch 1 on; 16 PPC with switch 2 on).
switch 6= divides the master clock by 1/32 (24 PPC with switch 1 on; 8 PPC with switch 2 on).
switch 7= divides the master clock by 1/64 (12 PPC with switch 1 on; 4 PPC with switch 2 on).
switch 8= divides the master clock by 1/128 (6 PPC with switch 1 on; 2 PPC with switch 2 on).

The 4-switch block is used to determine whether the internal clock is the master or an external clock is the master.

On the 4-switch block:

switches 1 and 2= internal clock.
switches 3 and 4= external clock.

switches 1 and 4 = receives 192 PPC clock.
switches 3 and 4 = receives 64 PPC clock.

For recording sequences and putting sync tones on tape, switches 1 and 3 on the 8-switch block have to be down (produces a 192 PPC sync tone); switches 1 and 2 have to be down on the 4-switch block. Or switches 1 and 4 can be down on the 8-switch block, which will produce a 96 PPC sync tone, which can be used to drive external devices that read 96 PPC clocks.

For syncing to a signal on tape switches 1 and 4 should be down on the 4-switch block to receive a 192 PPC sync tone.

74. Rhythm. 5-pin socket for connecting rhythm machines. The pins are used as follows:

pin 1= start/stop (output of the Wave's run function).
pin 2= ground.
pin 3= clock out (ouput of the Wave's internal clock).
pin 4= no connection.
pin 5= clock in (input for an external clock or pulses from a sync-to-tape signal).

Pins 1 and 3 provide a +12-Volt square wave.
Pin 5 needs to see a +1-Volt pulse or a sinusoidal 2-Volt peak-to-peak waveform.

75. **Communications-Bus.** This is a computer socket used for connecting the PPG to the Waveterm sampling system, the PRK-FD keyboard, the EVU expander, and future PPG developements.

76. **MIDI In, Out, Thru.** 5-pin DIN MIDI connectors. When hooking the PPG Wave 2.3 into a MIDI system, use the MIDI in when you want to slave the PPG to an external MIDI controller (sequencer, master keyboard, etc). Use the MIDI out when you want to use the PPG as the master controller. Use the MIDI thru to pass signals present at the MIDI in on to other MIDIed devices.

77. **Channel outputs.** Individual outputs for each voice used for running voices into a mixing board individually when recording. Allows you to add effects, EQ, and so on to each voice separately.

78. **Voltage selector.** Used for selecting whether the 2.3 will be run using 115 volts AC (USA) or 220 volts AC (Europe). On more recent models, this switch is on the inside of the PPG.

79. **Power-cord connector.** Hook the AC power cord up here.

80. **On/Off.** Switch for turning the PPG on and off.